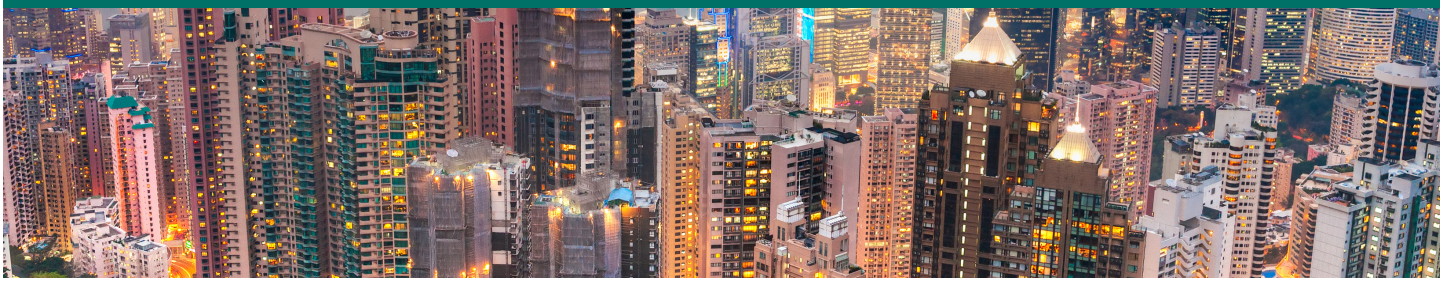
The Initiative on Financing for Resilient and Green Urban Global Solutions (FRUGS)

Financing for Resilient and Green Urban Solutions in Beira, Mozambique



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The Initiative on Financing for Resilient and Green Urban Global Solutions (FRUGS)

Financing for Resilient and Green Urban Solutions in Beira, Mozambique

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LIST OF ABBREVIATIONS

AFD	French Development Agency
AfDB	African Development Bank
AIAS	National Administration of Infrastructures for Water Supply and Sanitation
ANE	National Roads Administration
APIE	National Administration of State Property Assets
ARA	Regional Water Regulatory Agencies
BCI	Banco Comercial e de Investimentos
CAHF	Centre for Affordable Housing Finance in Africa
CBD	Central Beira District
CCTAP	World Bank Climate Change Technical Assistance Project
CDM	Clean Development Mechanism
CdM	Cornelder de Mozambique
CFM	Mozambique Ports & Railways
CMB	Municipal Council of Beira
CPMZ	Mozambique-Zimbabwe Pipeline Company
DAGRS	Department for the Environment and Management of Solid Waste
DANIDA	Development Cooperation of Denmark
DFID	UK Department for International Development
DNA	National Water Directorate
DNHU	National Directorate for Housing and Urbanization
DUAT	Right (Lease) to Use and Employ Land
EDM	Electricity of Mozambique
FAO	UN Food and Agriculture Organization
FCGD	Coordinating Forum for Delegated Management
FE	National Roads Fund
FFH	Housing Development Fund
FIPAG AO Beira	Fund for the Investment and Heritage of Water Supply
FRELIMO	Mozambique Liberation Front
FUNAE	Energy Fund
FUSP	Frysian Urban Sanitation Program
GCF	Green Climate Fund
GEF	Global Environment Facility
GIZ	German Corporation for International Cooperation
HCB	Hydroelectric of Cahora Bassa
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFI	International Financial Institutions
INE	National Statistical Institute
INGC	National Disaster Management Agency
IPP	Independent Power Producers
IsDB	Islamic Development Bank
KFW	German Reconstruction Credit Institute
LIDS	Low-Impact Development Strategies
MAE	Ministry of State Administration
MDG	Millenium Development Goals Fund
MDM	Democratic Movement of Mozambique

MICOA	Ministry for the Coordination of Environmental Affairs
MIGA	Multilateral Investment Guarantee Agency
MITADER	National Ministry of Land, Environment and Rural Development
MOE	Ministry of Energy
MOPH	Ministry of Public Works and Housing
MPI	Multidimensional Poverty Index
MSL	Mean Sea Level
MTC	Ministry of Transport and Communications
MZN	Mozambican New Metical
NAPA	National Adaptation Programme of Action
NRW	Non-Revenue Water
PPCR	Pilot Program for Climate Resilience
PPP	Public-Private Partnerships
RENAMO	Mozambique National Resistance
SASB	Beira Autonomous Sanitation Services
SDC	Swiss Agency for Development and Cooperation
SME	Small/Medium Enterprise
UMC	Climate Change Coordination Unit
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
VEI	Vitens Evides International

Executive Summary

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1. City Profile

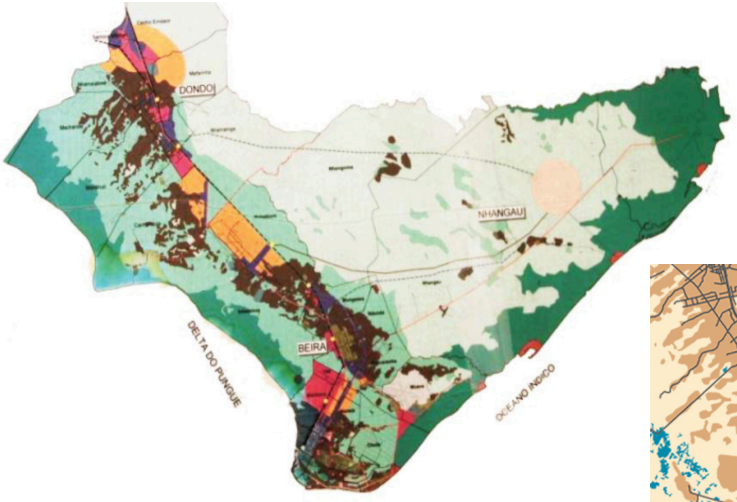
Beira is the third largest city in Mozambique. It lies in the central region of the country in Sofala Province, where the Pungwe River meets the Indian Ocean. It holds the regionally significant Port of Beira which acts as a gateway for both the central interior portion of the country as well as the land-locked nations of Zimbabwe, Zambia and Malawi. Beira was originally developed by the Portuguese Mozambique Company in the 19th century, and directly developed by the Portuguese colonial government from 1947 until Mozambique gained its independence from Portugal in 1975.

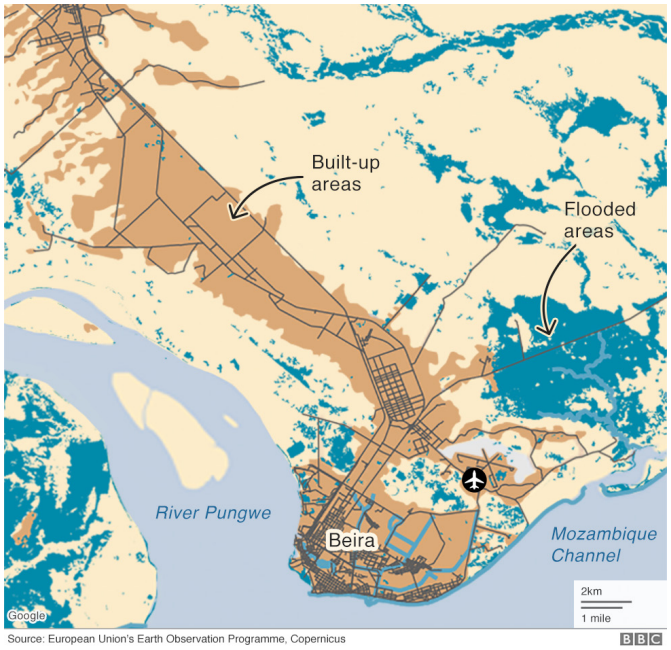
The Mozambican port city of Beira is estimated to be home to just over 600,000 residents and is expected to grow to between 830,000 and 1.4 million residents at an annual growth rate of between 2.25 percent to 4.25 percent by the year 2035. Of these current residents it is estimated that at present, 40 percent live in flood zones; 70 percent live in housing that is substandard in at least one major aspect of construction; 25 percent do not have access to solid waste management services; 60 percent do not have regular access to quality energy sources; 45 percent (and likely more) do not have access to a consistent and quality source of water; and an estimated 45 percent dispose of human waste in a way poses a threat to public health.

2. Finance gap and challenges

2.1 Housing Finance Gap

There is a huge housing finance gap in Beira. This report estimates that the current housing finance gap is roughly USD 435 million. By 2035, the financing gap in the housing sector is expected to rise by an additional USD 370 million to 2.26 billion (based on a per-unit cost range of USD 9,000 to 55,000) if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 1.38 billion to 8.4 billion if urbanization follows high growth rate estimates (4.25%).





Source: European Union's Earth Observation Programme, Copernicus

BBC

2.2 Finance Needs for Transport

The cost estimate for updating Beira's road network such that all roads are paved and of climate-robust construction is USD 225 million (with an associated average annual recurring maintenance cost of USD 12 million). Extending Beira's road network to cover 80 percent of the metropolitan area and maintain constant spatial density as the population grows and developed area expands would require an additional USD 71 million in construction costs and an additional USD 4 million in maintenance costs per year.

With respect to rolling stock, the financing required to provide full public transit coverage to city of Beira is estimated at USD 49 million in fixed capital assets, and USD 46 million to USD 74 million annually for operations and maintenance. By 2035, the financing requirements for rolling stock are expected to rise by an additional USD 66 million (fixed capital assets) and USD 62 million to USD 100 million (operations and maintenance) if urbanization follows low growth rate estimates (2.25% annually); or by as much as USD 113.8 million (fixed capital assets) and USD 107 million to USD 171 million (operations and maintenance) if urbanization follows high growth rate estimates (4.25%).

2.3 Finance Needs for Energy

In the energy sector, the cost estimate for meeting the current demand gap via expansion of the power grid is USD 57.3 million; By 2035, the financing requirements for grid extension are expected to rise by an additional USD 32.8 million if urbanization follows low growth rate estimates, or by as much as USD 122.6 million if urbanization follows high growth rate estimates.

2.4 Finance Needs for Water and Sewage

With regards to drinking water supply, the cost of meeting the current demand gap via expansion of the water grid is estimated at USD 4 million; by 2035, the financing gap for these water grid connections is estimated to grow by an additional USD 3 million if urbanization follows low growth rate, or by as much as USD 10.7 million if urbanization follows high growth rate estimates (4.25%). We further estimate that the current treatment works must expand to 171 percent their current capacity to meet the current demand gap, and to between 221 percent to 356 percent each of the previous urbanization scenarios. The cost of supplying sewer or septic system connections to non-served populations is estimated USD 77.6 million at present; by 2035, the financing gap for these solutions would be estimated to grow by an additional USD 33.5 million if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 125 million if urbanization follows high growth rate estimates (4.25%). Should these solutions be implemented, meeting the current demand gap would require the municipal waste treatment capability to expand to as much as 194 percent to 335 percent its current size (based on estimates of low and high per capita waste generation rates) ; to meet each of the 2035 urbanization scenarios, the treatment works would need to increase to between 263 to 455 percent their current capacity (low-growth scenario), or to between 452 to 783 percent their current capacity, respectively.

2.5 Financing Needs in Solid Waste Management

In the solid waste management sector, full service coverage would require roughly USD 0.6 million in fixed capital investment, and USD 1.1 million -2.1 million (based on variable waste generation rates) in annual operations and maintenance costs. In 2035, these financing requirements are estimated to increase by an additional USD 1.8 million (fixed capital investment) and a total operations and maintenance financing requirement of approximately USD 2.9 million annually (for a

low urbanization rate); or by an additional USD 4.5 million (fixed capital investment) with a total operations and maintenance requirement of USD 5.1 million per year.

2.6 Financing Needs for Disaster Management

Beira's risk exposure to extreme weather events is estimated by the national disaster management authority at 20% of the city's fixed capital asset value (or roughly USD 580 million). Beira's total fixed capital asset stock was valued at USD 2.9 billion and is expected to grow to USD 13.6 billion by 2030. Should this proportion hold, Beira's exposure will increase to USD 2.72 billion. The last major weather event to hit Beira in 2000 caused USD 60 million in asset damage. In 2012 the Mozambican national disaster management agency INGC estimates that Beira's expected annual economic loss due to climate change would rise to between USD 20 to 185 million sometime within the next two decades. The current financing requirement for direct mitigation measures is estimated at between USD 270 million to 357.9 million.

This indicates an infrastructure and services financing gap that, should the urbanization rate approximate the 4.25 percent high-growth estimate, could far exceed USD 9.8 billion (this analysis was not able to estimate the costs of necessary expansions of power generation, and water and waste treatment facilities) by 2035, with associated recurring operations and maintenance costs amounting to several hundred million USD per year (see the Table below).

Unfortunately for Beira, this level of investment is completely unsupportable by the local economy. The total market capitalization of the Mozambique Stock Exchange at the end of 2016 was MZN 61.697 billion, which given a period average exchange rate of 63 MZN/

Table: Current and Future Financing Gaps by Sectors, USD Millions in Beira

Sector	Current financing gap		2035 financing needs Low growth (2.25%)		2035 financing needs High growth (4.25%)		Notes
	Infrastructure	Annual 0&m	Infrastructure	Annual 0&m	Infrastructure	Annual 0&m	
Housing	435	n/a	370 - 2,260	n/a	1,380 -8,400	n/a	Cost range (USD 9,000 -TO 55,000 per unit)
Roads	225	12	71 million in infrastructure; 4 million in maintainance				Mainraining current spartial density over 80 percent of the geographical area
Public Transportation	49	46-74	17	16-26	65	61-97	Public bus service
Energy	57.3	n/a	32.8	n/a	122.6	n/a	None
Water	4	n/a	3	n/a	10.7	n/a	Does not include cost of expanded treatment works
Sanitation	77.6	33.5	n/a	125	n/a	n/a	Does not include cost of expanded treatment works
Solid Water	0.6	1.1-2.1	1.8	2.9	4.5	5.1	None

Source: Authors' calculation

USD, amounts to roughly USD 1 billion . In Mozambique, formal employment in urban areas is estimated at only about 65 perce¬¬nt; only about 12 percent of Mozambicans were formally banked (likely higher in urban areas); as of 2009 only an estimated 3.4 percent of urban adults had ever received a loan from a formal financial institution. The average urban household expenditure of the bottom three quintiles in 2014-15 is estimated at MZN 4,042 per month, which at a period average exchange rate of 31 MZN/USD amounts to roughly USD 130. In Mozambique generally and in Beira specifically, there is not a consumer base large enough to support expensive services, there is not a tax base large enough to support expensive investments in public infrastructure, and there are not enough households with the earnings and credit history necessary to obtain a loan for the purposes of formally developing a small business, or for buying a home.

Finally, macroeconomic volatility and mismanagement of fiscal resources has made it difficult for foreign investors to accept the risks associated with pursuing opportunities inside Mozambique beyond the nation's lucrative and export-facing natural resource sectors.

3. Under-developed Financial Markets

Many of Beira's low-income households construct their homes incrementally using cash because the costs of developer-constructed housing, a zoned plot, and associated municipal permits are affordable only to upper-income households. These households generally do not participate in formal financial markets because products and services are beyond their means. In 2015, the cheapest newly built house in Mozambique was USD 16,169, while the average household annual income was USD2,693. Only 1.7 percent of urban households can afford the cheapest formal houses. Home loans in Mozambique tend to have high minimum loan amounts (USD5,000) and high annual interest rates (the banks' lending interest rate to their prime customers was 23.25% in 2016, the home loans' interest rates are often higher than the prime lending interest rates) , the average lending interest rate was 27.86% in 2018 , which are far beyond the reach of most households. Furthermore, many people do not have the documentation of legal land titles, financial collaterals, and documented credit history necessary to obtain a loan.

There are also regulatory challenges for developing the housing finance markets. Mozambique's land is owned by the Government. The registration and cadastre systems still only cover limited urban areas, which are difficult to resell. This limits the amount of formally financeable land through mortgages and contributes to a general lack of clarity on property titles and transactions. There is little financial market support from the government for low-income households seeking to obtain home loans, which ensures that there is little incentive for private sector actors to cater to this demographic change. By 2011, its total fertility rate was estimated at an average of 5.9 children per woman, one of the highest in the world, despite the slow-down of the fertility.

Financial sector underdevelopment impedes the growth of small and medium-sized businesses. Real estate developers and Mozambican financial institutions cater mostly to financially stable businesses that have quality credit history and assets that can be used as collaterals.

4. Municipal Government faces serious capacity challenges

Many residents live in low-elevation, informal developments that have expanded haphazardly, often into flood zones. Their lack of formal planning stops the city from regulating their spatial layout and expanding public infrastructure in a safe, efficient or strategic manner, or allocating its land resources for other development projects.

The municipal government lacks an ability to manage data related to the conditions,

performance, and location of its bureaucracies and assets. For example, a recent partnership with Vitens Evides International revealed that the city lacks a map of its water grid. The city experiences low revenue collection rates due to these resource management issues, which threatens the solvency of public utilities.

This analysis determined that the financial requirements associated with maintaining and operating a public infrastructure and services network that would serve the entire city across all sectors would exceed the fiscal capacity of the local government. For example, it estimated that given current per-capita cost levels, even if municipal water utility FIPAG AO Beira achieved a tariff collection rate of 100 percent, it would still manage to recover only about 70 percent of its expenditures. In the sanitation sector, it estimated that the municipality would only be able recover about 38 percent of its costs under the same circumstances.

5. Financing Instruments and Practices

Investors and commercial financial institutions in Beira target low-risk opportunities in sectors with strong and stable revenue streams, such as the high-end real estate market, export-facing natural resource industries such as aluminium, electricity, coal, gas, tobacco, sugar, and gemstones, and associated logistical support industries. Small-scale coal exports in the region can be facilitated by trucking or limited rail operations, but these are seen as temporary measures until the expansion of the Sena rail line connecting Tete province to the port city of Beira is completed. The port at Beira experiences expansion. Currently, the rail line can transport approximately 2 million tons of coal per year, but it is projected to eventually have a capacity of 12 million to 18 million tons per year . The port can generate stable cash flows as the rapid increase of its transported volume, this will reduce the financial risks for the port development.

It is unclear whether private or public institutions commonly use risk transfer mechanisms. Extreme weather causes a substantial amount of economic loss in Beira.

Financing improvements in infrastructure is difficult for public institutions, businesses, and households because the majority of such improvements are paid for in cash. In Mozambique, there are heavy restrictions on municipal debt so as not to place the solvency of the government at risk. A large portion of the annual budget of the municipal government is transfers from the national government, and donor funds.

6. Challenges and Obstacles to Close the Financing Gap

Financial markets

The level of investment required to completely meet the financing gap in Beira can't be sourced from the local economy. The total market capitalization of the Mozambique Stock Exchange at the end of 2016 was MZN 61.697 billion; given a period average exchange rate of 63 MZN/USD this amounts to roughly USD 1 billion. Macroeconomic volatility and mismanagement of fiscal resources have made it difficult for foreign investors to accept the risks associated with pursuing opportunities inside Mozambique beyond the nation's lucrative and export-facing natural resource sectors.

Public Institutions

Infrastructure and service coverage in Beira is limited mostly to the wealthier areas of the city. Despite this, public utility providers still are unable to charge cost-reflective tariffs. The municipal government of Beira currently spends all the revenue it takes in on an annual basis. Substantial changes in the amount of annual funding committed to Beira by donors could have dire implications for the ability of the city to provide services to its residents.

Households

This study found that at current tariff levels,

roughly only the top two quintiles of households in Beira would have the means to meet the affordability benchmarks set in this report for public services. Households of these means live at subsistence level and are unable to consume public services at an average level at current tariff levels without being financially burdened.

7. Recommendations and Solutions

The recommendations offered in the report on Beira focus on several key areas:

- Investment in technologies such as digitalized government records system with low recurring costs that will improve the administrative capacity and fiscal efficiency of the local government.
- Establishment of development and resource management policies that will reduce economic risk due to extreme weather events and will reduce the cost of follow-on development
- Finding low-cost ways to solve issues that pose an outsize risk to public health.
- Identifying opportunities for private and financial sector involvement in the local economy.

This approach will allow Beira and its partners to immediately address areas of key importance with respect to public health while respecting the fact that complete urban modernization is a long-term proposition that must move in lockstep with economic development. These principles are illustrated in the following sections.

How to Close the Financial Gaps and Scale Up Financing

Closing the financial gap in infrastructure involves:

- Use private finance initiatives in public infrastructure and service development, for example, a private company can develop a section of the road and to maintain it over the whole contract period. It is paid by public money regularly for the private investment.
- Using economic policy instruments to transfer funds from strong, relatively low-risk sectors (like shipping, energy, and other natural resources), to underdeveloped and high-risk sectors (like local finance and housing development)
- Spreading financial risk of an investment initiative amongst multiple partners so as to decrease the risk faced by any single partner Scalability ultimately depends on the organic growth of the city's economic base. Mozambique has enjoyed strong real economic growth in recent years. The strategies above will increase the number of Beirans that pay taxes, own homes, and participate in financial and product markets, and will increase the efficiency and profitability of the city's public utilities and services. In the long term, this will generate economic activity and public funds that can be used for further social and economic development.

Financial Innovations

Several financial innovations can to be introduced to the local market. One is a middle-income mortgage product. This will not address the majority of the formal housing gap, but it will help expand a housing market that has not yet developed beyond offering housing options to high-income households. This will ideally increase the taxpaying base of the city, will increase the number of formally banked and legally documented homeowners, increase the number of Beirans with non-cash financial assets, and increase the number of participants in local financial markets. This instrument will likely require some amount of risk-mitigation support for private developers and financers.

Another is municipal debt instruments or liability via public-private partnership or private sector concession - the government of Beira does not currently have the fiscal capacity or technical capability to improve its publically-managed infrastructure (water, sanitation, and transportation).

A third is a social investment fund. Beira is an indispensable transit point for several regional natural resource sectors. Businesses in this sector are able to do business with international partners that finance transactions in stable international currencies. Other local industries include shipping, an airport, and tourism, all of which benefit from municipal infrastructure. The municipality should explore the feasibility of an economic policy instrument that can capture some of the gains in these sectors and use them to support less developed sectors.
Other financial innovations that should be explored include regional risk transfer mechanisms to mitigate the economic risks associated with extreme weather events, to be financed via mandatory insurance payments from residential and commercial developments in high-risk areas, and social policies that grant land or resource use rights to private entities in exchange for investments in housing or other infrastructure.

Catalyst roles for International Development Financial Institutions and Government

There are several key roles that the government and its international partners can play in creating an environment conducive to infrastructure development. These are generally:

- Supporting the development of financial and housing markets by using financial resources, and new legal and policy instruments to decrease the financial risk to investors
- Reducing costs and wait times associated with development permitting and zoning
- Creating and implementing a strategic development plan
- Strictly enforcing land use rights so as to decrease the costs to developers associated with land disputes
- Identifying profitable partnership opportunities for private and financial sector partners
- Conducting microeconomic studies to gather key information on the local economy that can assist investors and prospective new businesses in identifying profitable ventures

International Development Financial Instit tions in particular should:

- Seek opportunities to defray the economic risks faced by local partners, for example, to provide guarantees for investment or finance.
- Assist the local government in identifying affordable risk transfer mechanisms to insure economic loss due to extreme weather
- Fund initiatives aiming at increasing the administrative capacity and fiscal efficiency of local government
- Identify green and low-cost technologies that have been successfully applied under similar circumstances

Strategies to Promote Financial Sector Development

There are several low-cost strategies detailed in the main report on Beira City for inducing financial sector development and promoting greater private sector participation development. These are:

- Improving the ability of public utilities to collect tariffs and to maintain spatial data and other records of their assets and infrastructure
- Improving the ability of the local government to regulate the use of land resources
- Reducing the costs associated with obtaining land development rights

By doing these things, the local government will reduce the costs to developers associated with land use and will be better able to identify profitable opportunities for partnerships with private entities in the management of public utilities.

Strategies for soliciting greater private and financial sector participation in finance include using policy instruments to subsidize or cross-subsidize services and infrastructure, as well as using the resources of the state and its international development financial institution

partners to share the financial risk associated with the establishment of new financial instruments and homes for the middle-income market segment and small businesses.

Key financing opportunities in the city

Pilot Project: Technical Assistance for Developing a Land Management System

Beira lacks a formal land management entity capable of meeting the large demand for zoned and serviced plots in a timely and cost-effective manner. This results in substantially inflated costs of development and incentivizes circumvention of city regulators. Such an office is integral to the ability of the municipality to properly adhere to any strategic urban development plan.

FRUGS study find that the municipal government of Beira lacks a formal land management entity capable of meeting the large demand for zoned and serviced plots in timely and cost-effective manner. The effects of this are two-fold: first, it results in substantially inflated costs of development; and second, it provides an incentive, especially for low-income prospective home builders, to circumvent city regulators, which in turn subverts the ability of the local government to accurately maintain spatial data regarding urban expansion.

For this reason, we recommend a feasibility study focusing both on administration and cost to evaluate how the City of Beira would implement a Land Management Authority and develop a proper land management system.

Pilot Project: Transforming and adapting the existing housing stock and making it more resilient to crisis and climate change:

Cyclone Idai in March 2019 almost ruined the entire city of Beira, and damaged more than 90% of the city. Cyclone idai raised the alarm on the importance of making the housing stock more resilient to crisis and climate change.

The requirement for transforming the existing housing stock are primarily related to the damage caused by flooding and erosion to homes and household assets.

The available options for intervention in the housing sector include:

a) Upgrading the existing housing stock or making them climate-proofing/climate-resilient for those in hazard zones;
b) Resettling those households located in hazard zones;
c) Upgrading coastal defenses and improvement of drainage;
d) Establishment of conservation and restricted development zones and directing growth towards “safe zones.”
e) Relocating residents in flood zones to safe areas.

In addition to the public health hazard and investment challenges that they represent, Beira’s poor informal settlements also pose a massive strategic and logistical challenge. The exact sizes, locations and configurations of these informal settlements are often not officially documented, and consequently they can often obstruct or delay attempts by the city and developers to plan for or implement a project.

The scenario that places Beira most at risk involves a combination of progressive, long-term mean sea level rise, seasonal fluctuations in sea level, and increasing frequency and severity of weather events including Cyclones. Given the current state of coastal defense, quasi-permanent (i.e. extremely frequent) spikes in sea level of 5m or greater over the course of the 21st century would expose central/downtown and much of coastal Beira to extensive flooding.

Pilot Project: Develop a low-income housing market and design measures to prevent the spread of unplanned informal settlements:

Further FRUGS work is needed to provide technical assistance in creating a low-income housing market that includes low-cost options for purchase, rental, and self-construction; It also needs to address the proliferation of shantytowns in unplanned and low-lying coastal areas. Beira’s large and growing, informal

settlements are a significant impediment to proper urban development and damage the investment attractiveness. They also inhibit the ability of the municipal government to properly regulate urban growth, collect taxes, and designate and prepare land for development. These settlements additionally encourage the proliferation of unregulated and informal economic activity and impede the ability of the city to provide water, power, sanitation, waste management and transportation services.

Pilot Project: Upgrading the infrastructure, urban services, and making them more climate-resilient:

Infrastructure and service underdevelopment in four sectors in Beira pose the greatest risks to public safety; these sectors are water, sanitation, solid waste management, and flood management. Further FRUGS work can focus on strategies and techniques and finance on how to address the issues and develop sustainable solutions to the following problems. Haphazardly-constructed and poor-quality water infrastructure often backflows during flooding. It additionally makes it difficult for the city to properly maintain its pipeline network. Frequent service outages force people to turn to non-potable water sources for drinking water.

Beira's sanitation services and sewer network are extremely underdeveloped and of poor quality. Improper disposal of human waste and flooding often combine to contaminate drinking water sources and increase the incidence of waterborne disease.

Beira's solid waste management properly services the majority of the city. However, services are not provided to poor and unplanned peri-urban neighborhoods. Improper disposal of solid waste can impede the function of natural drainage infrastructure and contribute to flooding and drinking water contamination. It also frequently results in pollution due to unauthorized and environmentally unsafe waste disposal (burning and burying).

Eroding and inadequate coastal defense infrastructure (preventing erosion of coastline and managing sea level surges) and flood management infrastructure contribute to high social economic costs to the city during extreme weather events such as Cyclones. Severe flooding and storm damage exacerbates the above detailed weakness in housing and infrastructure, in addition to also causing power outages and damaging roadways. In low-lying coastal areas, coastal defense infrastructure can be considered to be pre-requisite for ensuring the survivability of other urban infrastructure; absent coastal defense existing and future critical infrastructure in these areas is likely to be degraded quickly or not function properly in times of need. During Cyclone Idai in March 2019, more than 90 percent of the city were flooded and experienced severe damage.

Pilot Project on the rehabilitation and expansion of the drinking water grid and associated water treatment works in Beira:

The 2035 Master Plan estimates that the combined cost of such an initiative would range from EUR 35 million to ERU 60 million. As the plan notes, the revenue model for water is relatively straightforward, as it is largely fee-for-service. The city government of Beira will require assistance in identifying instances in which private sector partnerships or finance partnerships are most likely to be both useful and cost-effective.

The municipal government of Beira and the local division of the national water utility have partnered with Vitens Evides International with the objective of improving access to water, water quality, service hours, and the financial position of the utility. Projects include:

- The rehabilitation and update of the pipe network
- A modest extension of 85 kilometers
- An expansion in production capacity of 10 percent
- The repair of faulty meters

- The improvement upon collection rates
- The improvement of network management, customer support, and technical troubleshooting

For new partners, Vitens Evides represents a credible partner with the management expertise necessary to properly co-manage funding alongside the municipal government. The mandate of the partnership should expand to include exploring opportunities to strategically orient existing and new development for easy follow-on development.

Pilot Project on the rehabilitation and expansion of the city sanitation grid in Beira:

The city sanitation grid similarly must be both rehabilitated and expanded in a way that is consistent with city development goals. The 2035 Master Plan estimates the cost of this initiative to be between EUR 20 million and EUR 40 million. It estimates that the possible cost of this initiative could exceed USD 75 million. This sector similarly operates with a fee-for-service revenue model, and so might be well-suited to private sector participation or international finance partners. Additionally, low-cost decentralized methods for sanitation should be explored.

The Frysian Urban Sanitation Project (FUSP) Consortium and WASTE urban development and environmental consultants have partnered with the municipal government of Beira to identify local businesses that work within the sanitation sector and provide them technical training, education in entrepreneurship, business development support, and connections to local financial institutions. The objective of the partnership is to expand decentralized private-sector solutions to the sanitation service coverage gap. The FUSP and WASTE program partnership notes that financial institutions in Mozambique have little experience with business models in the sanitation sector.

Pilot Project on improving flood management:

The ability to properly manage storm water remains a major concern. The 2035 Master Plan proposes measures to improve coastal protection and drainage. The plan estimates a combined cost of these initiatives between EUR 74 million to ERU 100 million. This report cites cost estimates that the full range of necessary improvements might exceed USD 350 million. It is difficult to generate revenues from these types of infrastructure investments; possible sources of revenue that might partially offset initial expenditures include mandatory insurance premiums, or development schemes that combine flood management infrastructure with other types of commercial and residential development. However, the city should consider whether it can reduce the amount of necessary expenditure on drainage and coastal protection infrastructure in the long run by pivoting development to low-hazard areas.

Pilot Project: The Maraza New Town Project

This new neighborhood adjacent to the airport will be formally planned and accommodative of the natural terrain so as to allow the city to take advantage of natural storm water drainage. Each plot will be zoned for easy connection to city infrastructure, and to allow for follow-on, self-constructed expansion of the core housing unit. Housing units will be financed and constructed by the housing development enterprise Reall, which will start by pursuing a pilot project 10 percent of the size of the planned project.

Opportunities for donor involvement include the development of a low-cost housing template; addressing the shortage of low-cost building materials; and the development of a mortgage product or rent-to-own product.

Pilot Project: Solid Waste Management

This report estimates that the municipal government of Beira successfully manages seventy-five percent of the city's solid waste,

proving that it has the institutional capacity to handle service provision in this sector. Funding in this sector should be dedicated to expanding the capacity of municipal solid waste management services. Closing the demand gap in this sector will reduce improper disposal of solid waste in improper ways, including burying, burning, and discarding into critical drainage canals.

There are also options for development in this sector that can take place via small business loans disbursed by the FUSP/WASTE partnership. These are: identifying and implementing business models that make use of recyclable materials, such as fuel briquettes and compost made from organic waste, and building materials made from recycled plastics; and siphoning landfill byproduct methane for use as an energy source.

Pilot Project: Drainage

A joint initiative between the municipal government of Beira and German development partners GIZ and KfW has sought to fix poorly-functioning tertiary drainage infrastructure in several neighborhoods. The project employed local labor and equipment contracted through the municipal government and provided on-the-job technical training to laborers and community education regarding proper maintenance of drainage infrastructure.

Donor funding should be allocated to continue this initiative to clean and rehabilitate drainage infrastructure, with a particular focus being paid to at-risk informal settlements on the coast. There is no clear method of direct cost recovery for this project.

END NOTES

[1] Market capitalization data sourced from Mozambique Stock Exchange website www.bvm.co.mz; exchange rate data sourced from data.worldbank.org

[2] Market capitalization data sourced from Mozambique Stock Exchange website www.bvm.co.mz; exchange rate data sourced from data.worldbank.org

Chapter 1

History of the City

1967 US Army Map of Beira, with original planned city[3]

Colonial port

The City of Beira was formally founded in 1890 as a trading post for the Portuguese colonies, administered by the Companhia de Moçambique (Company of Mozambique), which was granted a concession to the natural resources located in the hinterland. Beira is located on the eastern coat of the African continent on a peninsula near the mouths of the Pungue and Pio rivers and the Indian Ocean. Since its origins, Beira has grown into one of the most important ports in the region; it connects neighboring landlocked countries Malawi, Zambia, and Zimbabwe to the coast. The City of Beira was incorporated as the Municipal Council of Beira in 1946, and with the independence of Mozambique in 1975, the city became the capital of Sofala province. It is also the country's second largest urban center following the Maputo/Matola metropolitan area.

Hinterland connections to natural resources

In 1892, a rail line was built to connect the port of Beira to Salisbury (now Harare), the capital of Rhodesia (now Zimbabwe), which was a booming mining town. It was later extended to connect Malawi, Zambia, and the Democratic Republic of Congo. A highway was later built to provide an alternate transport option to Harare; the highway, now known as the Trans-African 9, extends through Harare, Lusaka (the capital city of Zambia), Lubumbashi (the second largest city in the Democratic Republic of the Congo), and ends in Angola, at the West African port city of Lobito. Finally, a gas pipeline was built in 1960 to provide petrol to Zimbabwe.

MDM party versus FRELIMO party

After independence from Portugal in 1975,

Mozambique had a period of civil war from 1977 to 1992 between the Marxist FRELIMO, which controlled the government, and the rebels of RENAMO. During this period there was extreme famine, disease and a significant increase in poverty. In Beira, around 1,000 homeless Beirans occupied the famous Grande Hotel, which by the end of the civil war was in near-ruins.

During the campaign for the local elections in 2013, which culminated in the victory of the Democratic Movement of Mozambique (MDM) in the municipality, the Munhava district was the scene of violent clashes between police and supporters of the MDM.

1.1 Geography and Land Use

Terrain

The terrain of the City of Beira is primarily flat with tan average elevation of 6 meters above mean sea level.[4]

Soil

It is estimated that greater than 70 percent of the population in and around Beira participates to some extent in the agricultural sector.[5,6] Thus, it is likely that the soil is generally suitable for agricultural activity. The 2014 study "Comprehensive Review of the Waste Sector" conducted by Carbon Africa Limited notes that small-scale farmers in peri-urban areas often prefer to grow vegetables with short maturity times so that they can sell their produce often.[7] Practiced monoculture presents risks to the soil that threaten the sustainability of the farming operations over the long term.[8]

Land Use

Phase 1 – Establishment of the port and expansion within the peninsula and lowland flood zones

The structure or spatial form of the city is centralized around the port, its primary economic generator, with four major arterial or avenue roads extending radially to covers the inland areas. In the 1940s-1950s the city structure was expanded, and secondary roads were constructed to increase development of the lands adjacent to the avenues, forming a small grid structure complete with roundabouts at each intersection. In this area, now considered as the Central Beira District (CBD), many neoclassical and art deco buildings were constructed and still exist.
In subsequent decades, the spatial form of the city grew at a relatively slow pace, with the conversion of rice fields, farms and marshlands into formal low-density housing communities. This approach progressed until the peninsula was completely developed.

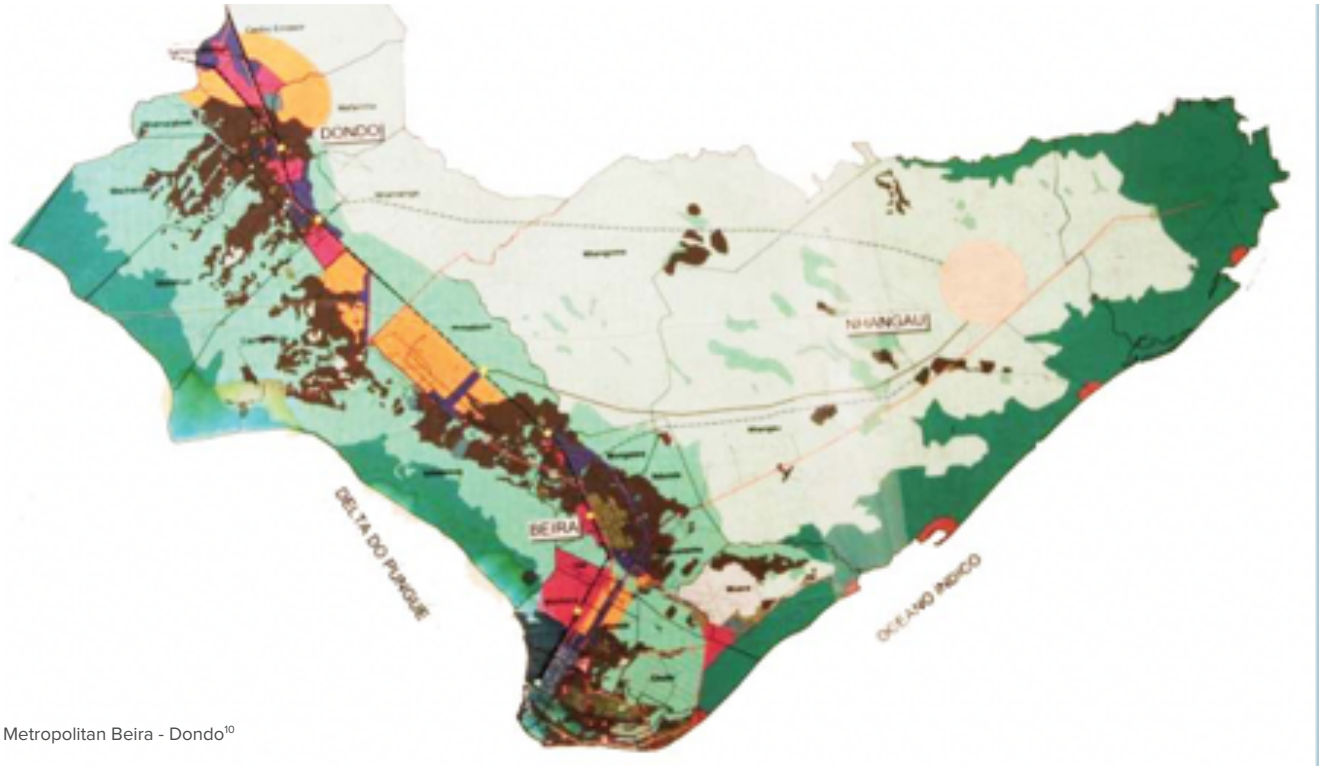
Phase 2 – Expansion along main roads towards Dondo

Afterwards, new housing settlements began spreading inland along the arterials roads and highway, including the establishment of sub-town centers at Manga, Chamba, and Dondo. Dondo later became an independent incorporated municipal council.

Phase 3 – Establishment of new town centers

The spatial growth of the city accelerated in the 1980s and after as many rural residents migrated to the urban centers of Mozambique to escape the civil war that consumed the rural parts of the country. The migration was also driven by those seeking jobs and higher wages. This rapid increase in population led to a swell of informal and unplanned housing settlements on the periphery of the planned city center. Seeking to be as close as possible to the business located in the CBD, the migrants established their households in the marshlands and coastal tidal zones that the previously generation avoided. This final evolution has led to the greatest climate change threat to the City of Beira and has been the primary management challenge for the municipal council.

Beira from the sky[9]



Metropolitan Beira - Dondo[10]

Urban Design

In evaluation of land use and urban design, you could characterize the residential area of the City of Beira into four zones.

- **City Center** - Also known as the Cement City it is the historical planned city. The population density is low as the primary purpose of these areas are commercial activates.
- **Suburban Formal Settlements** - These are Beira's formally planned neighborhoods. They are the product of urbanization induced by the extension of Beira's arterial roads. They are connected to the city transportation grid. These include the neighborhoods of Chamba, Macurungo, Macuti, Manga, Marora, Maquinio, Pequeno Brasil and Ponta Gea
- **High Density Informal Settlements** – These areas are expansive and made up of poor quality housing stock and unpaved road. They extend primarily to the north and east of the planned city, below the airport.
- **Low Density Informal Settlements** –These settlements are like those described above. They extend largely into the underdeveloped agricultural areas around the northern edge of the city.

1.2 Climate Change Vulnerability

The climate in Beira can be characterized as both a tropical wet and dry savannah climate with rainy seasons from December to March.

The annual average temperature in Beira in the period from 2008-2012 was roughly 25.1o C. The temperatures peak in the months of October to March, where the average high temperatures range from 30o-32o C. The coolest months are in July and August, where the average high temperatures range from 25o-26o C.[11]

The average annual rainfall typically does not exceed 2500 mm. The precipitation patterns peak in the months of December to March, where the average rainfall ranges between 200-300 mm per month. The driest months are in May to September, where the average monthly rainfall often does not exceed 50 mm. The tidal levels of seafront can vary from 1 up to 6 meters per day, with the highest levels being witnessed in the Spring months.[12]

Sea level rise and coastal erosion

The National Institute for Disaster Management (INGC) has been constructing risk estimates on the assumption that seal level rise by the

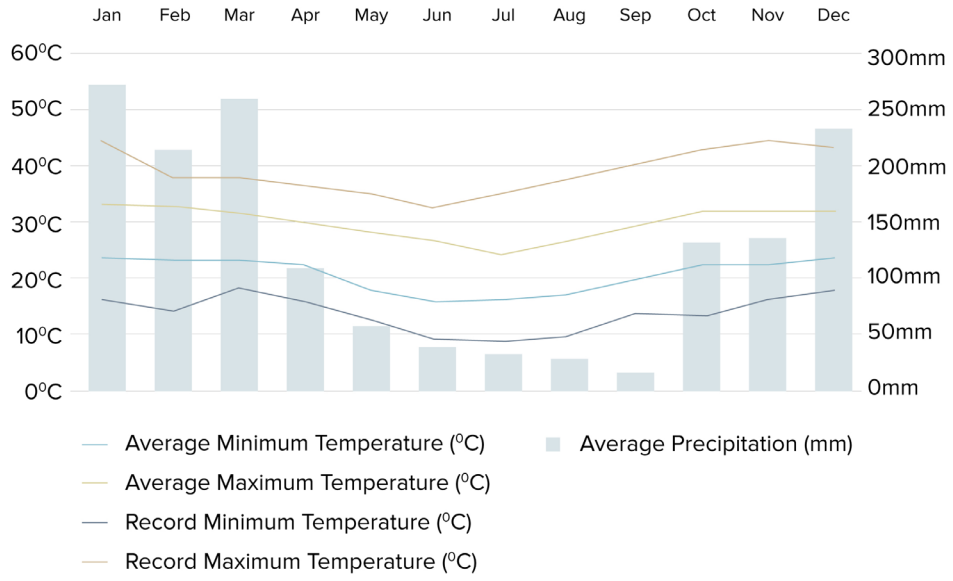
Table 1.1 Monthly Temperatures and Precipitation Patterns in Beira[13]

Average maximum and minimum temperatures and precipitation in Beira[4]

Month	Jan	Feb	Mar	Apr	May	Jun
Avg. high [C]	32	32	31	30	27	28
Avg. low [C]	24	24	23	22	19	18
Avg. precipitation [mm]	272	210	259	103	62	32

Month	Jul	Aug	Sep	Oct	Nov	Dec
Avg. high [C]	25	26	28	31	31	31
Avg. low [C]	16	17	18	22	22	23
Avg. precipitation [mm]	30	28	21	117	119	240

Figure 1.1: Average max. and min. temperatures and precipitation in Beira[14]



year 2100 will be somewhere between 0.5 meters and 2 meters over current levels.[15] The municipality has reported that the southernmost part of the city's coastline has been receding at a rate of 5 meters per year for the last twenty years.[16]

Increasing volatility of precipitation patterns and inland flooding

In October and November 1999, heavy rainfall affected Mozambique, followed by another period of heavy rainfall in January 2000. By the end of January 2000, the rains had caused the Incomati, the Umbeluzi, and the Limpopo rivers to exceed their banks, inundating portions of the capital Maputo. At Chókwè, the Limpopo River reached a level 6 m (20 ft) above normal on January 24, twice its normal level. Some areas received a year's worth of rainfall in two weeks. The resultant floods were considered the worst to affect the nations since 1951. Beira experienced large amounts of economic damage and many residents were displaced. By the late January, the flooding had already caused increases in malaria and diarrhea. It disrupted water supply and covered roads, with the primary north-south highway cut in three locations. Nationally, it displaced about 220,000 people, and killed about 150 people. Flooding had begun to recede in late February 2000, when Cyclone Eline made landfall. Eline was a long-lasting tropical cyclone that struck near Beira at peak intensity on February 22.

The combined effects of the preceding floods and Eline left about 463,000 people displaced or homeless across the country, including 46,000 children five years old or younger. Altogether, the preceding floods and Eline caused about 700 deaths, half of which occurred in Chokwe, a city slightly north of Maputo. Nationwide, damage was estimated at $500 million (2000 constant USD). The cyclone and the floods disrupted much of the economic progress Mozambique had made in the 1990s since the end of its civil war. By 2000, the situation was considered the country's worst natural disaster in a century.[17]

In the City of Beira specifically, parts of the informal townships in Chaimite, Munhava, Matacuane, Macurungo, Chipangara and Chota are already up to ten meters below sea level. They are also where some of the cities' most vulnerable and poorest inhabitants live. People

in these townships live under the constant threat of flooding, mostly during the rainy season and during cyclones when seawater enters the drainage ditches. The vulnerability of the population in these townships is particularly high due to the density of the dwellings, the lack of infrastructure and the generally depressed socio-economic conditions.

Families are especially susceptible to floods occurring at night with little or no warning. Without an appropriate response strategy, the situation will get worse in the decades to come. Major areas of the central neighborhoods could become uninhabitable within the next 20 years.[18]

Mozambique's per capita CO2 emissions are 0.1 tons per year. This is significantly lower than the global average (4.9 tons) and even lower than the average of low-income countries in general (0.3 tons). Yet, Mozambique has been ranked third among African countries most exposed to risks from climate-related disasters, and the cost of inaction on climate change has been estimated at USD 450 million per year.[19] This is a clear reason for the country's strong priority on adaptation – instead of mitigation – in its climate change policies and strategies. Since 2000, Mozambique's concerns regarding climate change have increased due to successive floods.

This has led to government resettlement programs, mainly in the Limpopo and Zambezi valleys. The government encourages farmers living in resettlement villages to access new land in high zones for use during the wet season, but to commute to from their original low zone fields during the dry season, when there is a smaller risk on flooding. There is little data available on the numbers moved or socio-economic impact, despite the scale of the resettlement programs.

Beira After being hit by Cyclone Idai in March 2019

Beira After being hit by Cyclone Idai in March 2019

Source: https://www.dw.com/en/after-cyclone-idai-beira-has-found-itself-in-the-dark/a-48008877

Source: https://www.dw.com/en/after-cyclone-idai-beira-has-found-itself-in-the-dark/a-48008877

1.3 Population

1.3.1 Current Inhabitants

City of Beira

The National Institute of Statistics (INE) estimates that the City of Beira has a population of 462,904 residents as of 2016. The last official census was in 2007 when the population was surveyed to be 443,369. This translates into a population growth rate of 0.46 percent. INE also projects that the population will be 522,214 by the year 2040 using an average growth rate of 0.50 percent.

Third party estimates of Beira's population are significantly higher. The Beira 2035 Master Plan projected low- and high-growth scenarios (2.25 percent and 4.25 percent, respectively) outwards from the 2007 census to establish their 2035 population projection figures of 827,000 and 1,422,000 residents. Based on these growth rates the actual 2017 population of Beira would likely be between 550,000 and 670,000 residents. Because we use these growth rate figures to project future demand scenarios, we will select a midpoint estimate of Beira's current population, at roughly 610,000 residents.

With an administrative area of 631 square kilometers, the City of Beira has an implied population density of roughly 967 residents per square kilometer. However, much of the northern periphery of the City is either unpopulated or sparsely populated because there are no roads and the area is partly an estuary. This situation is also recognized for large area along the riverbanks north of the port terminal. As a result, the habitable area of the City of Beira is reduced by almost 40 percent, leaving roughly 379 square kilometers of land available. Using these lower area figures the population density is 1,609 residents per square kilometer.

Sub-Districts of Beira

Within the City of Beira, there are 5 urban districts, and 26 barrios, or neighborhoods, the lowest administrative and spatial unit within Mozambique.[20]

Table 1.2 Beira 2007 Population by Urban District and Bairros[21]

	Neighborhood	2007 Population		District, Estimated Percent of Total
1	Chaimite	14,883	3.4%	38.4%
	Chipangara	26,723	6.0%	
	Esturro	25,503	5.8%	
	Macurrungo	22,367	5.0%	
	Macuti	14,789	3.3%	
	Matacuane	36,894	8.3%	
	Pioneiros	6,722	1.5%	
	Ponta Gea	22,276	5.0%	
2	Chota	-	-	16.4%
	Mananga	-	-	
	Maraza	-	-	
	Munhava	-	-	
	Vaz	-	-	
3	Alto da Manga	20,987	4.7%	23.4%
	Chingussura	-	-	
	Inhamizua	-	-	
	Matadouro	-	-	
	Nhaconjo	-	-	
	Vila Massane	24,677	5.6%	
4	Mascarenha	29,135	6.6%	12.0%
	Muave	9,467	2.1%	
	Mungassa	4,018	0.9%	
	Ndunda	10,529	2.4%	
5	Nhangau	-	-	9.8%
	Nhangoma	-	-	
	Tchondja	-	-	

*Data is missing for many of the neighborhoods; based on the remaining uncounted population, we estimated that each of the remaining neighborhoods was on average home to about 14,500 people, or about 3.28 percent of the total population in 2007.

1.3.2 Future Growth

As previously mentioned, there is a range of estimates for population growth. The variability is a result of the calculation methodology that relies on multiple independent variables such as birth rates, death rates, migration rates, and economic growth rates. Therefore, these projections should be used as upper and lower limits.

For this study, however, the lower-bound and upper-bound population estimates from the 2035 Beira Master Plan (827,000 residents, and 1,422,000 residents, respectively) will be used as the estimation range for this report. The INE estimate of 604,000 residents by 2035 is nearly in direct contradiction of other federal department estimates of Beira's current population. For example, FIPAG, the federal entity responsible for water infrastructure investment and water service provision estimated Beira's population at just over 590,000 in 2014. Thus, the higher estimates seem more likely. These projections, built from the last official census in 2007 (population estimate: 443,369), are summarized below.

Spatial Growth

In terms of spatial growth, the Beira has historically growth radially and at a low population density largely due to unregulated and unenforced land use management practices.

However, this is not the only option. There are multiple trajectories that could be realized depending on the density trends and land use controls. In order to produce a comparable analysis, the study will consider two primary scenarios: (i) spatial growth following the historic population density trends, and (ii) spatial growth following increased population density trends.

Option A – Land use growth with existing average density (larger footprint)

The current average density of Beira over the existing developed area is estimated at 1,609 persons per square kilometer. In order to accommodate the upper limit of 1,422,000 residents the city would need to grow beyond its current administrative boundaries (631 square kilometers) to 884 square kilometers to maintain current average density.

Option B – Land use growth with increased density (smaller footprint)

If density increased by 50 percent, or to 2,415 persons per square kilometer, the developed area of the city would need to grow from 379 square kilometers, to 589 square kilometers to accommodate the upper estimate of 1,422,000 residents. This is an increase from 60% of the current administrative area (631 square kilometers) to roughly 93% of the current administrative area.

If density increased by 25 percent, or 2,011 persons per square kilometer, the city would need to grow beyond its current administrative boundaries (631 square kilometers) to 707 square kilometers to accommodate the upper estimate of 1,422,000 residents.

Table 1.3 Growth scenarios for Beira 2035[22]

Scenario	INE	low growth	middle-growth	high growth
Growth rate	1.1%	2.25%	3.25%	4.25%
Basis Population (2035)	INE projection 604 000	National growth rate, provincial growth rate 827 000	Average national urban growth rate 1 088 000	Maximum national urban growth rate 1 422 000

Figure 1.2a: Beira residential expansion: Low-growth scenario[23]

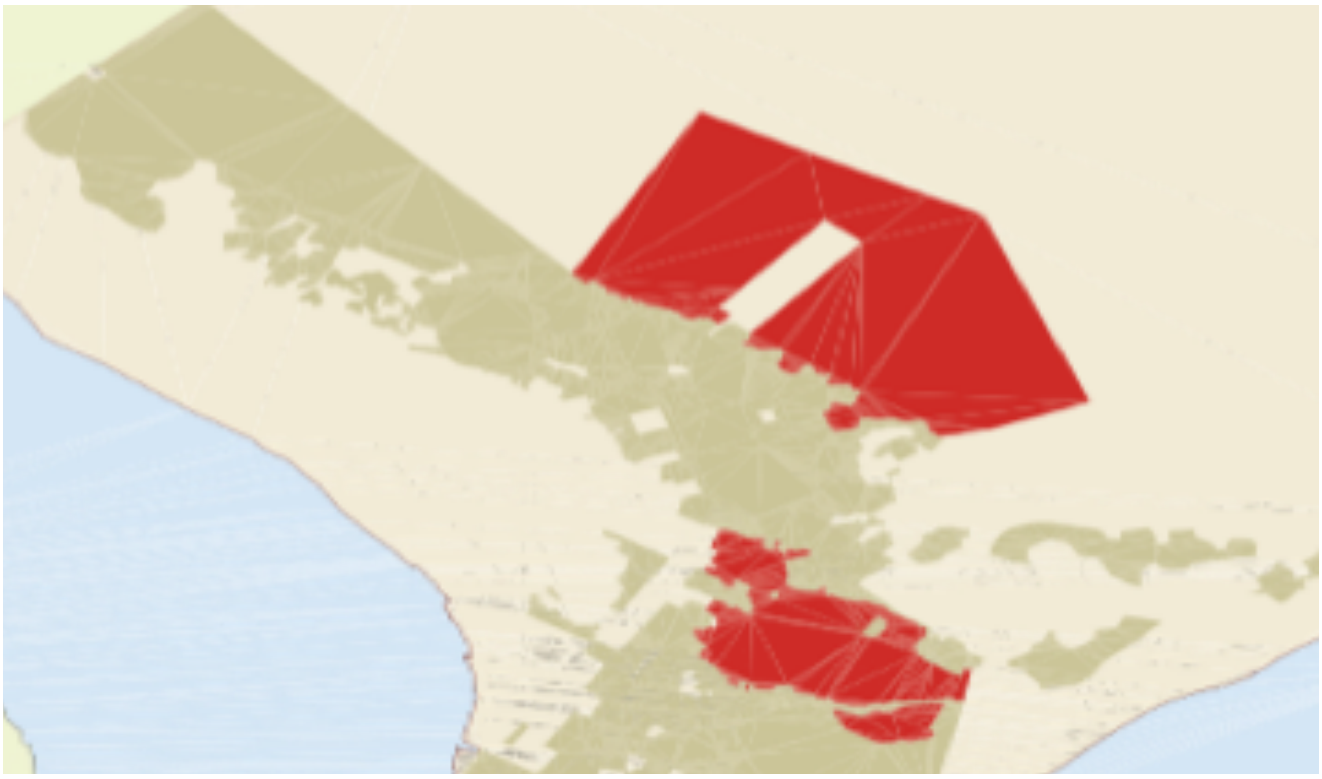


*Table Notes: Likely future growth requirements in red

Figure 1.2b: Beira residential expansion: High-growth scenario[24]

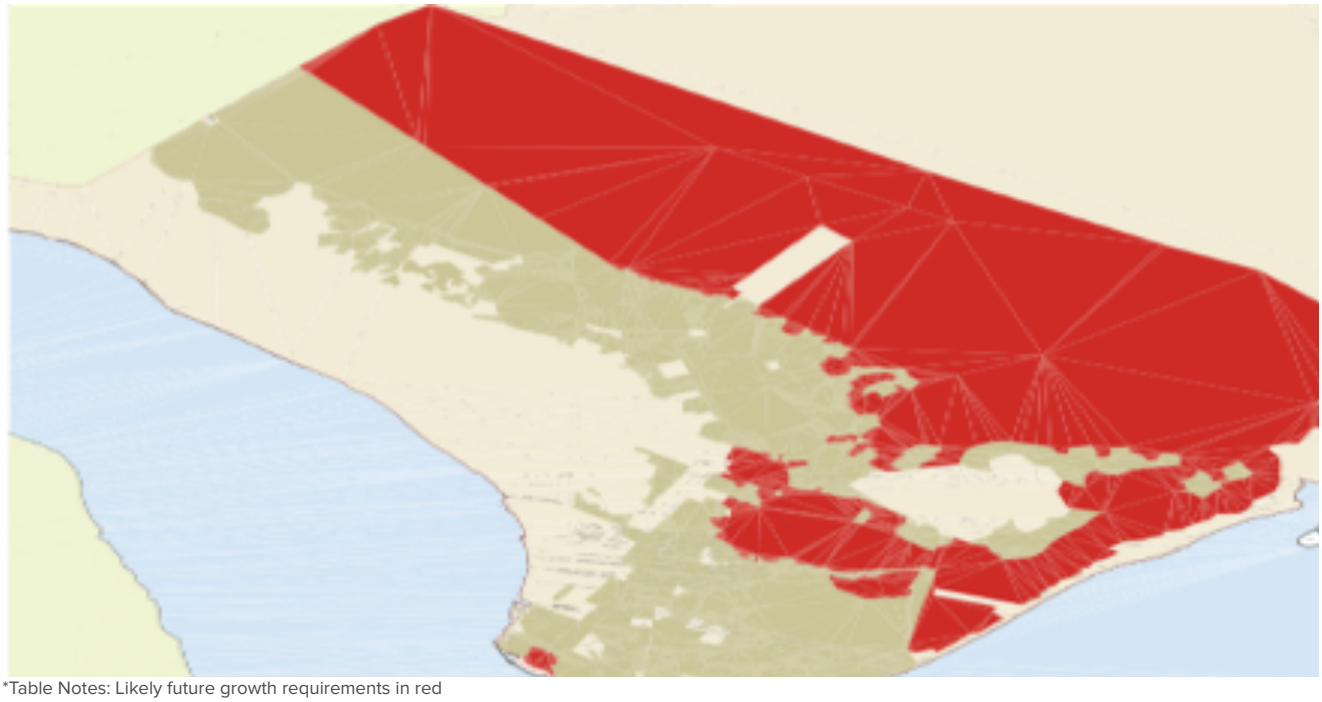
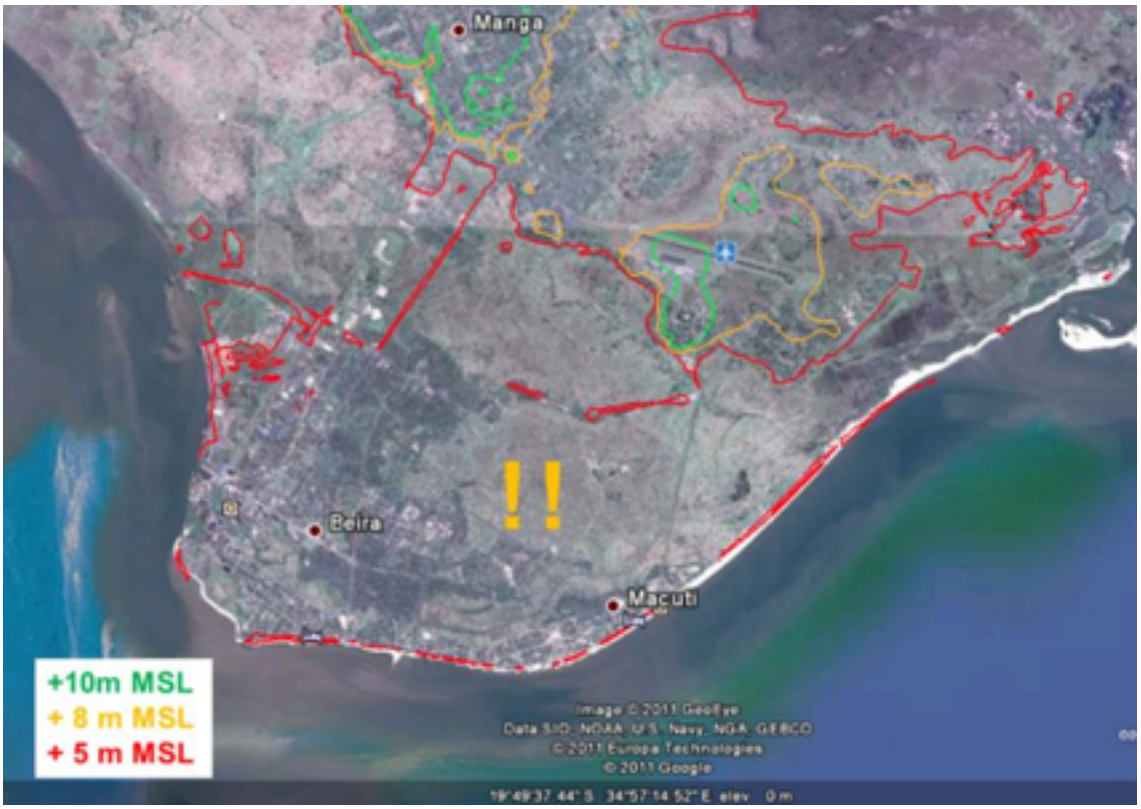


*Table Notes: Likely future growth requirements in red

Figure 1.4: At-Risk Areas of Beira, by Mean Sea Level Rise[25]



Radial directions of spatial growth

The land available in Beira to support this growth is very limited. Almost most of the unutilized land bordering the coast is at high risk for flooding. Therefore, the majority of should be directed inland along the highway, EN6, or by increasing the density of existing built-up areas. However, given past trends, it is likely that most of the growth will occur in the flood zones

1.4 Economic Structure

1.4.1 National Economy

Mozambique is the 100th largest export economy in the world and the 123rd most complex economy according to the Economic Complexity Index (ECI). In 2014, Mozambique exported $7.27 billion and imported $10.3 billion, resulting in a negative trade balance of $3.04 billion. In 2014 the GDP of Mozambique was $15.9 billion and its GDP per capita was $1,130. Although agriculture-related activities account for roughly a quarter of Mozambique's GDP, only about 10% of private investment is directed toward the agriculture sector.[26]

The top exports of Mozambique are Raw Aluminium ($1.42 billion), Aluminium Bars ($1.05 billion), Petroleum Gas ($671 million), Refined Petroleum ($603 million) and Coke ($488 million), using the 1992 revision of the HS (Harmonized System) classification. Its top imports are Refined Petroleum ($1.34 billion), Raw Aluminium ($513 million), Ferroalloys ($321 million), Delivery Trucks ($316 million) and Telephones ($266 million).

The top export destinations of Mozambique are South Africa ($1.16 billion), the Netherlands ($1.14 billion), India ($638 million), China ($541 million) and Singapore ($474 million). The top import

Figure 1.5a: Composition of Mozambique Exports

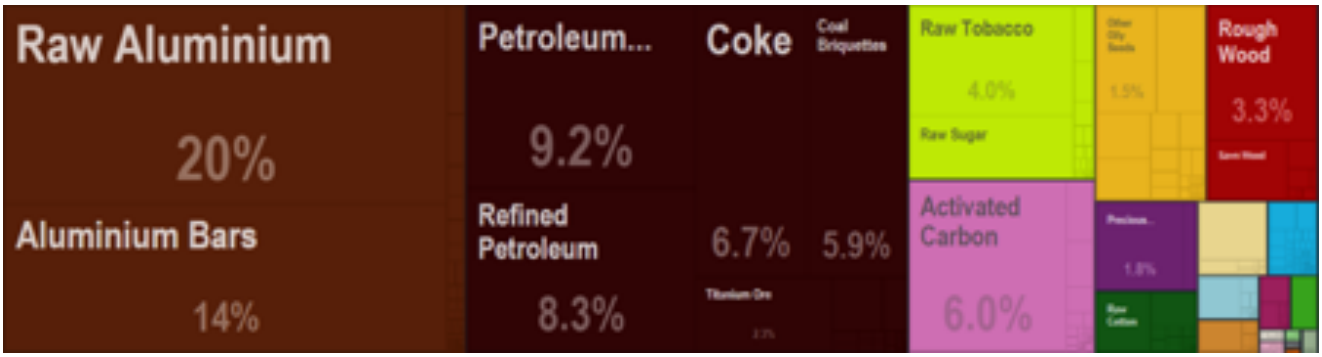


Figure 1.5 b: Composition of Mozambique Imports

origins are South Africa ($2.75 billion), China ($1.06 billion), Bahrain ($700 million), the Netherlands ($595 million) and Zimbabwe ($532 million). Mozambique borders Malawi, Swaziland, Tanzania, South Africa, Zambia and Zimbabwe by land and Comoros and Madagascar by sea.[27]

World Bank data estimates the GDP of Mozambique in 2016 was $14.86 billion (2010 constant USD), and that GDP has been growing at an average nominal rate of 6.96 percent per year over the past 10 years, with an average annual inflation rate of about 5.78 percent over the same period. With an estimated total population of 28,829,500, this translates into a 2016 GDP per capita figure of $515 (2010 constant USD) using basic calculation methods. As such, these figures can be misleading given that more than 22 percent of Mozambicans are unemployed and over 87 percent are underemployed.

Mozambique is ranked 181 on the UN Development Program's 2016 Human Development Index, behind Sierra Leone and tied with South Sudan. It is classified as a Low Development country. The Multidimensional Poverty Index (MPI), which evaluates poverty with ten individual indicators across three major categories (health, education, and living standards), defines multidimensional poverty as that in which some individual falls below the poverty threshold for one-third or more of the weighted indicators. In 2016, poverty headcount measures deriving from this data placed an estimated 70.2 percent of Mozambique's population in multidimensional poverty, while an additional 14.8 percent live in near-multidimensional poverty.

1.4.2 Provincial Economy

According the INE estimates, the GDP of Sofala Province contributes 12 percent of the national GDP, which for 2016 would be USD 1.78 billion (in 2010 constant USD). According the last official census, the population of Sofala

Table 1.4: **Sample Survey of Sofala Province Industry Yields**

Industry	2013/2014 Season Yield
Farmed crops	1,982,000 metric tons
Farmed Meat	1,249 metric tons
Commercial Fishing	35,305 metric tons
Sawn Timber	17,993 cubic meters
Tourism	108,843 overnight stays
Mineral Mining	109,514 cubic meters (44% of planned)

province in 2007 was 1,642,920. The population of Mozambique has been growing at a steady rate of about 2.9 percent for the past decade; with an estimated 2016 population of 2,124,980 million. In Sofala, 2016 GDP per capita was USD 837 (2010 constant USD).

The provincial economy is reliant on the exploitation of natural resources and tourism. Natural resources abundantly available include land suitable for agriculture (3.27 million hectares of arable land, 1.67 million hectares of pasture); coastal ocean areas suitable for commercial fishing (estimated capture of 141,120 metric tons per year); commercial-grade timber (1.42 million hectares of forest); minerals and hydrocarbons (including fluorite, calcite, gold, decorative stones, limestone, sand, guano and plaster); and national parks, wildlife reserves, and ocean coastline that all attract tourists.

The total value exported goods from Sofala province during this period was estimated at roughly USD 393.78 million. Additionally, the operations of the Port of Beira and connected highways and railways are essential to regional commerce and are integral to the provincial economy.

1.4.3 City Economy

GDP per capita and growth

Beira's GDP in 2010 was estimated at USD 439 million; its fixed capital asset stock in 2010 was valued at USD 2.9 billion. By 2030, these values are expected to increase to USD 2.05 billion, and USD 13.6 billion, respectively.[30]

Port is a leading driver of economy, exports and jobs[31]

The national economy of Mozambique is representative of the economy of the City of Beira in terms of composition. Similar to most cities in Mozambique such as Maputo, Nacala and Pemba, the City of Beira was established as a trade port, which still dominates the economic activities of the sector. Most of the goods transferred at the port are exports from the coal industry. This business sector, and its supporting services, support numerous high paying jobs, but is only a small employer in comparison to the total urban population.

The port of Beira is the second largest port in Mozambique. Because the nearest comparable ports are over 1000 kilometers away, the port plays a large role in each of local, national, and regional commerce. It is the primary point of sea-based import and export for the middle region of Mozambique and for neighboring landlocked countries Malawi, Zambia, and Zimbabwe. It is also the port situated closest to Mozambique's coal mines. The port is connected to major east-west and north-south arterial highways (which connect to the capital cities of Malawi, Zambia, and Zimbabwe) and two railways, one linking to Zimbabwe which carries 650,000 tons of cargo per year, and one linking to Malawi which carries 3 million tons of cargo per year.

Several factors limit the operating capacity of the port. A narrow access channel means that only one-way traffic to and from the port is possible, which creates long wait times. Additionally, the port only operates in daylight; inadequate lighting means that no night operating capacity

is possible. Regular sediment dredging of the Pungue delta is necessary to ensure that water depth allows ships to access the cargo terminals. Finally, road access to the port is inadequate and frequently becomes congested with commercial traffic.

The configuration of the port and its capacity and management are as follows. There are twelve total quays with quay 1 being the southernmost and closest to the mouth of the delta. The fishery terminal consists of quay 1 and is in poor condition. The multi-purpose and container terminal consist of quays 2-5 and their combined capacity is 100,000 twenty-foot equivalent units per year. The general cargo and dry bulk terminal consists of quays 6, 7, 9, and 10 and has a combined capacity of 2.3 million tons per year. Mozambique Ports & Railways Company (CFM) and Cornelder de Mozambique (CdM) jointly operate the container, general cargo, and dry bulk terminals. Despite their capacity, general cargo and dry bulk throughput in 2009 was reportedly 980,000 metric tons. The coal terminal consists of quay 8, which at the time of this report was being augmented to be able to handle over 5 million tons per year; it is operated by an enterprise partnership between private companies Vale and Rio Tinto. Quay 11 is an old fuel terminal that at the time of this report was unused and in disrepair, though it had designated for rehab to a multi-purpose container terminal by CFM and CdM. The current active fuel terminal consists of quay 12. In 2009, this terminal processed 900,000 metric tons of fuel, though it has the capacity to process 2.5 million tons per year. This terminal appears to be operated by the Mozambique – Zimbabwe Pipeline Company (CPMZ), which owns the connected pipeline.

Most residents in the City of Beira are reliant on informal trade and subsistence farming, which is conducted on the marshy peripheral area of town. Subsistence farming activities are largely unregulated and are conducted on land not owned by the individuals.

1.4.4 Household Economy

At the household level, INE produces a Family Budget Survey, which summarizes expenditures patterns. The data is aggregated at: (i) national and provincial levels and (ii) urban and rural areas. The expenditure patterns are summarized in Table 1.5. These statistics can be used to estimate the size of infrastructure and services sectors.

Employment statistics from 2005 supplied by the United Nations indicate that at that time, the agricultural sector accounted for 80.5 percent of employment; the services sector accounted for 16.1 percent of employment; and industry accounted for the remaining 3.4 percent. Data from the UN and the World Bank allow us to estimate a range for national unemployment in 2014 of 22 – 25 percent.[34]

1.5 Jurisdictional

The government of Mozambique has been undergoing a 25-year transition and evolution from a centralized economy where the state owned and operated all land, infrastructure and business enterprises, to a privatized market-based economy. This history has significant impact on the jurisdictional arrangements as municipality and utilizes have only existed for a relatively short period of time. The culture and

Table 1.5 Household Expenditure by Geographic Area (MZN Per Year)[32]

Area	2003/2003	2008/2009	2014/2015
National	1,559	3,368	6,924
Sofala Province	2,113	3,230	6,785
Urban	2,703	5,530	11,889
Rural	1,073	2,480	4,654

practice of taxation and fee collection and inter-governmental fiscal transfers is still developing. This complicates the situation for municipal governments and utilities that have been given the responsibility for infrastructure development and service provision. In order to facilitate these roles, legislation and policy do stipulate taxes and fiscal transfer; however, collection rates are well below the targeted level, and the revenue redistributions do not automatically happen.

The specific jurisdictional responsibilities for infrastructure development and operations of the national government, municipal government, and utilities are presented in Table 1.6.

1.5.1 Detailed Responsibilities for Key Urban Infrastructure and Services

The section below provides a detailed description of the institutional and process for delivery of urban infrastructure and services.

Licensing and Regulation of Land and Land Use[35]

In Mozambique, land is the property of the State and may not be sold or in any other way transferred, mortgaged or pledged. The conditions of use and exploitation of land are determined by the State. The Right to Use and Employ Land (Direito de Uso e Aproveitamento da Terra, or DUAT) is granted to natural or legal persons based on the approved social or economic purposes to which they mean to put the land. DUAT may be acquired from each level of government according to the location and size of the land tract desired. All Mozambican citizens are eligible to obtain DUAT; foreigners must obtain special permission from the government. DUAT are obtained through several mechanisms including: grant upon request; lottery; public competitive bidding; private transaction; and good-faith occupation.

Table 1.6 Jurisdictional Responsibilities for Land Management and Infrastructure

Sector	National Government	Utilities	Municipal Government
Land Use	• Ministry of Land, Environment and Rural Development (MITADER) • Ministry for Coordination of Environmental Affairs (MICOA)	• NA	• Directorate for Construction and Infrastructure
Housing	• Ministry of Public Works and Housing	• Housing Development Fund (FFH)	• Directorate for Health and Social Welfare
Water Supply	• Ministry of Public Works and Housing • National Water Directorate (DNA)	• Fund for Investment and Heritage of Water Supply (FIPAG) • Administration of Infrastructures for Water Supply and Sanitation (AIAS) • AO Beira	• Directorate for Health and Social Welfare
Wastewater	• Ministry of Public Works and Housing	• Administration of Infrastructures for Water Supply and Sanitation (AIAS) • Beira Autonomous Sanitation Services (SASB)	• Directorate for Health and Social Welfare
Power	• Ministry of Energy (MOE)	• Electricity of Mozambique (EDM)	• NA
Transportation	• Ministry of Transport & Communications (MTC)	• National Roads Administration (ANE)	

Within urban areas, DUATs are granted for enterprise purposes by municipal authorities based upon approved exploitation plans; these permits are for 50-year periods and are renewable. Urbanization in such areas must include not only the allocation and organization of spaces for private and public use but also plans for basic transit access, public infrastructure, social amenities and public services (e.g., health, education, drainage and access to commerce, among others). DUAT for residential occupancy are granted through application or by presenting evidence of good faith occupation for a period of 10 years. Tenure in these instances is perpetual.DUAT granted by local government must be registered with the Ministry of Justice to apply for mortgages, and with both the Ministry of Justice and the National Directorate of Land and Forests (DNTF), to obtain credit from a bank.

Although land cannot be sold or otherwise transferred, DUATs may be. The transfer between private parties of DUAT which pertain to urban structures or "prédios urbanos" (i.e. those whose principal value is in constructed assets rather than in land itself), do not require authorization of the entity that approved the initial grant of use rights (i.e. the municipality). By contrast, the transfer of DUAT related to land-based structures ("prédios rústicos"), wherever located, requires the authorization of the entity that approved the initial grant thereof. This provision for autonomous transfers of prédios urbanos allows for the development of a market for tradable land use rights in urbanized areas such as those typical of most municipal territories. Within this regime, municipal authorities function as administrators for land transfers and associated land use regulation and land taxation.

The main government entity responsible for environmental management in Mozambique is the MICOA. MICOA is the entity that approves environment impact studies, monitors the application of environmental management plans and otherwise supervises activities in the environmental sector. MICOA is also responsible for environmental licensing and inspection in respect of hazardous wastes and to carry out monitoring air and water quality, including within municipal territories.

While municipalities may establish municipal reserve areas and are responsible for maintaining green spaces and drainage areas within their boundaries, the great majority of powers in respect of the environment are concentrated in the central and local instrumentalities of the State. There is only a very limited role for municipal governments in environmental matters, and no statutory provision is made for cooperation between central and municipal authorities in respect of environmental protection in municipal territory.

Licensing and Regulation of Building Construction

Construction activity in Mozambique requires authorization by the Government. The authorization takes the form of a license (alvará) valid throughout the country. There are two basic types of licensed builders: public works builders and civil works builders.

Public works builders are licensed to carry out construction, reconstruction, repair and adaptation of real property for the state, municipal governments, and public institutes and companies. Private Works are defined as being all those belonging to proprietors who are not from direct or indirect administration bodies of the state or of local municipalities. Licensing encompasses all works to be executed and regarding a phased project, for each phase a license for construction shall be obtained. The competence to proceed with licensing of private works belongs to the municipalities or the district administrations, if outside of municipal boundaries.

Housing Provision

The attributions related to provision of housing include two aspects, namely, those assigned to the municipalities and those to decentralized state bodies. Concerning state intervention and the fact that the State had become

proprietor of most of the real property of the country via nationalizations, the Government established an agency for the Administration of State Property Assets (APIE). It equally falls to the state to construct real property for sale or lease, as well as practicing other activities related to real property rights.

The government also established the Fundo de Fomento de Habitação (FFH), whose general attribution is to assure financial support to government housing programs for families of lower-income, qualified labor force members and young couples. Most of the intervention of the FFH is within municipal boundaries. In such cases, the principle of the prior agreement between the FFH and APIE should govern its intervention.

At the same time, the competencies of municipalities include urbanization, construction and housing. In this context, the municipalities are along with the FFH responsible for public investment in housing. However, neither municipal legislation nor Decree 33/06 is clear with respect of the nature of the municipality's role, the resource base and beneficiary criteria, and the modalities for the planning, management and accomplishment of investments in the domain of housing.

Transport and Urban Roads

The road network in Mozambique is regulated and managed by of the National Roads Administration (ANE) supervised by the Ministry of Public Works and Housing (MOPH). Municipalities are responsible for maintenance of the network of roads, streets, and lanes within their boundaries except in the cases of primary and secondary roads as defined in the national roads policy framework and classification system.

Mozambique's roads are divided into four categories: primary (national), secondary (regional or provincial), tertiary (inter-district or subregional), and local ("vicinal," best translated as local roads). These vicinal roads include most rural roads which were once considered "unclassified" as well as streets and lanes which provide strictly local transport links. The maintenance of primary and secondary roads within municipal boundaries, many of which coincide with principle urban avenues and streets, are the responsibility of ANE in collaboration with municipal authorities. Thus, the construction and maintenance of some tertiary and all vicinal, and strictly municipal roads and lanes within their boundaries are the responsibility of the municipalities.

Local government legislation defines municipal competencies related to roads to include: management and maintenance of roads which integrate the urban and rural networks, except primary and secondary roads; coordination with ANE in relation to primary and secondary roads which cross the municipal area; finance of roads and connected infrastructures of urban roads; introduction of fees for the use of roads and connected infrastructures, under its jurisdiction; and concessions of exploration of roads under its jurisdiction.
A key feature of the roads sector is the legally mandated funding provided for municipal road maintenance from the National Roads Fund (Fundo Nacional de Estradas or "FE"), an earmarked state fund financed directly by fuel taxes. The legislation regarding the FE requires that 10 percent of revenues from fuel taxes be transferred to municipalities to finance maintenance of municipal roads and associated infrastructure.

The use of FE is in principle at the discretion of municipalities but in practice the FE has required them to provide plans and budgets as a precondition for disbursement and some adjustments regarding priorities and standards have been "requested" by the FE.

Water Supply

The National Water Directorate (DNA) is the body of the MOPH entrusted with the strategic and integrated management of water resources, as well as with the supply of drinking water and sanitation to the population. The DNA is thus the state entity responsible

for water supply policies and establishment the institutional arrangements through which these policies are implemented, and water supply services are delivered.
The municipal framework legislation states only that municipalities are in charge of public investment in municipal water supply systems. By contrast however, legislation specific to the water sector, approved in the context of policy reform and restructuring in order to permit delegation of management of public water supply systems to the private sector, provides for the transfer of the management of water supply systems for the benefit of the municipalities. This transfer of privately managed systems, however, has not yet taken place, and the municipalities are not yet exercising the corresponding powers. Indeed, water supply (as distinct from drainage) is noticeably absent from the list of competences to be assumed by the municipalities over the coming three to five years, as expressed in Decree 33/06.

Also, in addition to the regulating agency CRA, the public water asset investment fund FIPAG and DNA, the Regional Water Administrations (ARA's) are included in sectoral coordinating body for water resource management, the Coordinating Forum for Delegated Management (FCGD). The FCGD is an advisory body, which integrates representatives of principal entities involved in the delegated management process and works to harmonize their respective interests. Its members include a representative of each autarquia, as way of assuring the participation of the same in questions relating to delegated management of water supply.

Legally, the management of the water supply systems of the 13 (thirteen) urban systems directed by the State is at present allocated to FIPAG, the national public drinking water utility. FIPAG responsibility includes water supply for Maputo, Xai-Xai, Chókwe, Inhambane, Maxixe, Beira, Chimoio, Quelimane, Tete, Nampula, Nacala, Pemba and Lichinga. On an inter-institutional level, the municipalities are represented on the Boards of Directors of FIPAG and FCGD, participating in strategic deliberations and in decisions regarding the financing of specific projects.

At the same time, many independent water sources exist within municipal boundaries, including point sources (dug wells and boreholes) and small piped systems which are often privately developed and managed to provide water to households and enterprises in peri-urban areas where municipal and/or public enterprise supported distribution networks do not provide coverage. Both Provincial Water Departments (deriving their authority from the DNA) and municipal authorities are involved in the supervision of independent water providers; however clearer regulations and institutional mechanisms are needed to clarify their respective roles and responsibilities. Efforts to regulate the relationship between FIPAG and private urban water suppliers, through modest concession agreements incorporating service standards, are also in the pipeline.

Drainage (Sanitary Drains and Surface Water Drains)

The public drainage system is defined as the set of installations for drainage of both domestic and industrial waters as well as surface rainwater and runoff, including the network of collectors, pipes, gutters, canals, and complementary equipment/ installations. On a national level, the responsibility for surface water drains, comprising administrative and financial management of services and maintenance and operation of infrastructure, is assigned to the state or to municipalities and may be delegated to third parties. In Beira, sanitation is managed by the municipal Beira Autonomous Sanitation Services (SASB).

Decree 33/06 sets forth the transfer to municipalities of the competences related to planning and implementation of investments and the management of facilities supporting municipal drainage systems and the treatment of urban waste water and surface water.

Notwithstanding this legal instrument and the implicit policy for decentralization of drainage functions to the municipalities, as of 2008 it remains common that state institutions, namely the MoPH and its provincial directorates, continue to intervene directly in resolving urban drainage problems.

Electricity Provision and Public Lighting

In Mozambique the production, transportation, distribution and commercialization of electric energy is the responsibility of the public enterprise Electricidade de Moçambique E.P (EDM), under the supervision of the Ministry of Energy. In the energy domain, municipal legislation refers only to matters of investment in electric energy distribution and public lighting. On the inter-institutional level, there is no legal instrument that governs relations between the municipalities and EDM, which different municipalities conduct on a case-by-case basis. Municipalities typically submit requests to EDM to extend distribution networks and to provide public lighting in underserved neighborhoods and urban expansion areas; however, there is no requirement that EDM comply with these requests or respect urban development plans approved by the municipalities. Thus, collaboration between EDM and municipalities is voluntary, although municipalities may use their own resources to finance EDM-managed service expansion. Much of Beira's electricity is generated by the publicly-traded company Hidroeléctrica de Cahora Bassa (HCB), which operates a nearby hydroelectric dam.

It should be noted that the National Energy Policy affirms a policy of decentralization and the abolition of monopolies in electric energy production and distribution through the involvement of both the private sector and local authorities in order to guarantee more efficiency and competitiveness. This policy would seem to entail some transfer of the public service of electricity provision to the local authorities. However, by contrast, electricity is noticeably absent from the list of competences to be assumed by the municipalities over the coming three to five years, as expressed in Decree 33/06. Implicitly, there seems to have been a policy decision not to transfer either commercial electricity supply or public lighting to the municipalities for the foreseeable future.

Solid Waste Removal

The intervention of the State bodies in the domain of solid waste management is the responsibility of the Ministry of the Environment (MICOA) and consists of the preparation and publications of rules, licensing of installation or places of storage or elimination of wastes, and inspection of the compliance with regulations.

In general, the legal framework on basic sanitation, and in particular on management of urban solid waste, remits to the municipalities the attributions and competences related to rubbish removal, public cleaning, and associated investments for waste treatment and disposal. Thus, the municipalities are responsible for the collection and transport of non-dangerous urban solid wastes, employing the proper means, methods, and collection processes, based on what is technically relevant in each situation in order to guarantee hygienic conditions so as not to endanger public health and the environment.

Equally important is to mention the regulatory competence by the state and which is reserved to the municipalities in respect of waste management on the areas under its jurisdiction, namely on approval of specific provisions on waste management, removal processes, treatment and deposit of solid waste and other.

Parks and Green Spaces

Public investment and management of parks, gardens and botanical zones is one of the basic municipal competences. Green spaces are defined as the parks, gardens, ranks, squares, alleys, grassed boulevards and borders, zoos, botanical gardens and embankments, subject to rules of utilization and function approved by the municipality itself as well as rules of conduct to be complied with by private users.[36]

1.5.2 Centralized Government to Decentralization

Until the late 1990s, Mozambique's urban areas were under the political and administrative authority of the centralized state, both through the end of colonial rule in 1975 and during the period of unitary party-state rule which formally ended with the constitutional revision of 1990. The colonial administrative model provided for appointed political executives in the cities (administradores) who presided over "municipal boards" (câmaras municipais).
After national independence in 1975, the FRELIMO party-state established new institutional arrangements for urban governance and management. The formal public-sector apparatus, despite being renamed "executive councils" (conselhos executivos), remained in structure and function quite similar to the colonial-period câmaras.

As the economic crisis of the 1980's became pervasive, this "democratic centralism" began to weaken; in 1986–7 the FRELIMO central party-state began to relinquish control not only over the production and distribution of consumer goods, but also over the administration of urban services which were by 1990 increasingly delegated to the administradores and directors of sector ministries who comprised their conselhos executivos. The process of economic and political liberalization foreseen in the 1990 constitution, further propelled by provisions of the Rome Peace Accord of 1992 related to local governance, resulted in the formulation by the Ministry of State Administration (MAE) of a strategy for the introduction of decentralized local government in Mozambique.

The Municipal Framework Law, approved by Government and submitted to the legislature

Table 1.6 Jurisdictional Responsibilities for Land Management and Infrastructure

Sector	National Government	Utilities	Municipal Government
Land Use	• Ministry of Land, Environment and Rural Development (MITADER) • Ministry for Coordination of Environmental Affairs (MICOA)	• NA	• Directorate for Construction and Infrastructure
Housing	• Ministry of Public Works and Housing	• Housing Development Fund (FFH)	• Directorate for Health and Social Welfare
Water Supply	• Ministry of Public Works and Housing • National Water Directorate (DNA)	• Fund for Investment and Heritage of Water Supply (FIPAG) • Administration of Infrastructures for Water Supply and Sanitation (AIAS) • AO Beira	• Directorate for Health and Social Welfare
Wastewater	• Ministry of Public Works and Housing	• Administration of Infrastructures for Water Supply and Sanitation (AIAS) • Beira Autonomous Sanitation Services (SASB)	• Directorate for Health and Social Welfare
Power	• Ministry of Energy (MOE)	• Electricity of Mozambique (EDM)	• NA
Transportation	• Ministry of Transport & Communications (MTC)	• National Roads Administration (ANE)	

in 1994, foresaw the gradual introduction of statutory elected municipalities throughout the national territory. It eventually included all 23 cities and 121 districts. This law foresaw a single legal framework with minor variation in structure and functions tailored to the specificities of urban and rural contexts. The Municipal Framework Law was the last law approved by the single-party National Assembly before Mozambique's first multi-party general elections in October 1994. It marked a key moment in the country's transition toward liberal democracy.

After the newly elected government took office in early 1995, legal specialists and politicians raised formal and substantive concerns regarding the legality and the viability of the 1994 Municipal Framework Law. During its first 1997 session, the Assembly's FRELIMO majority alone passed the new Local Government Framework Law. It was followed by associated legislation that included laws structuring the creation of the first municipalities, municipal elections, municipal finance, municipal tutela (supervision), municipal office holders, and further specificities of Maputo municipality's office holders. Mozambique's municipal laws were implemented beginning in 1997, resulting in the first municipal elections late in that year. The first 23 elected municipal governments assumed office in January 1998. There tends to be a revenue collection mismatch between national and local government. The majority of collected revenues are received by the national government, which then returns some proportion via transfers.

The largest revenues sources for the country are from transport services related to the exports of natural resources. While Beira is the second largest destination of such activities, little of this revenue is shared with the Municipal Council. These sectors are also low employment sectors, so there is limited economic impact for local community.

Laws, Regulations, Policies and Strategic Plans Governing Infrastructure Provision include:

National Level

- 2011-2014 Poverty Reduction Strategy (PARPA III)
- 2010 National Policy and Strategy for Decentralization

Table 1.7 Jurisdictional Responsibilities for the Environment and Climate Change

Sector	National Government	Municipal Government
Environment	• Ministry of Land, Environment and Rural Development (MITADER) • Ministry for Coordination of Environmental Affairs (MICOA)	Directorate for Urbanization
Climate Change	• Ministry for Coordination of Environmental Affairs (MICOA)	Directorate for Urbanization
Disaster Risk Reduction	• Ministry of State Administration (MAE) • National Disaster Management Institute (INGC)	Directorate for Urbanization
Land Conservation	• Ministry for Coordination of Environmental Affairs (MICOA)	Directorate for Urbanization
Solid Waste Collection	• Ministry for Coordination of Environmental Affairs (MICOA)	Directorate for Health and Social Welfare
Air Quality	• Ministry for Coordination of Environmental Affairs (MICOA)	Directorate for Health and Social Welfare

- 2012 Strategy for Integrated Urban Solid Waste Management (EGIRSU)
- 2011-2015 Strategic Plan for Local Administration Sector (PESAL)
- National Sanitation Sector Policy

Municipal Level
- 2013-2035 Beira Master Plan (GPU)
- 2015 Maraza New Town Plan (PPU)

1.5.4 Responsibilities for Environment Conservation and Climate Change Mitigation

With regards to environmental and climate change risk management, the distribution of responsibilities is less defined. According to the national government, MICOA and INGC both share responsibilities in this sector. However, as a government entity MICOA and INGC are not given the direct ownership or operational responsibility for infrastructure assets or physical land and regulations. Therefore, to fulfill its mandate, MICOA must coordinate with and advocate to other government entities and business enterprises who have ownership, operational, and regulatory responsible for infrastructure and land.

The specific jurisdictional responsibilities for environment and climate change are presented in Table 1.7.

1.5.5 Strategies Initiatives and Policies for Climate Change Adaptation

The Government of Mozambique drafted a First National Communication on climate change in 2003, emphasizing coastal protection, agriculture and water resources. This was followed by the submission of a National Adaptation Programme of Action (NAPA) in 2008, with a continuation of these three themes and addition of early warning systems as a fourth. To date, only one project to address the NAPA priorities has been approved for funding - the United Nations Joint Programme on Environmental Mainstreaming and Adaptation to Climate Change, funded by the government of Spain, with a particular focus on strengthening adaptive capacity of agricultural producers.

In 2012, Mozambique launched its National Climate Change Strategy for 2013-2025. This strategy expands the focus from mere adaptation, to include mitigation and financing. Its three objectives are:

- Adaptation: To become resilient to impacts of climate change, while minimizing climate risks to people and property;
- Mitigation: To identify and implement opportunities to reduce GHG emissions;
- Capacity and resources: To build institutional and human capacity and explore opportunities to access technology and financial resources to implement this strategy.

Integration of climate awareness and targeted actions across the various line ministries will be critical for the success of climate change strategies. Responsibilities on climate change were so far distributed primarily over the Ministry of Planning and Development, the Ministry for the Coordination of Environmental Affairs (MICOA, the Designated Lead Authority on climate change under the UNFCCC50), and the National Disaster Management Institute (INGC), in cooperation with line ministries and sector bodies such as the Food Security Technical Secretariat (SETSAN).

A lack of coordination and cooperation between the various governmental actors has been mentioned by a number of sources as the major weakness in Mozambique's attempts to combat climate change effects. In order to improve this coordination, a Climate Change Coordination Unit (Unidade das Mudancas Climaticas, UMC) has become operational in 2014, with support from the World Bank's Climate Change Technical Assistance project (CCTAP). This UMC is intended to function as a cross-governmental body for coordination of climate change activities. It has started to develop a national monitoring and evaluation system for the National Climate Change Strategy, which will enable reporting to the Climate Investment Fund and to Mozambique's Council of Ministers. It has also started developing a climate knowledge management hub hosted by a Mozambican University (UEM).[37]

In January 2015, both the Ministry of Planning and Development and MICOA ceased to exist: the former was merged with the Ministry of Finance, while MICOA – being criticized for corruption and poor performance – was merged into a Ministry of Lands, Environment and Rural Development. It is still unclear how climate change responsibilities will be reshaped and redistributed.

Climate change poses challenges to many sectors, but until very recently, government has lacked a clear strategy for addressing these issues. Mozambique's only national communication to the UN Framework Convention on Climate Change was submitted in 2003. However, in recent years, climate change has acquired more prominence in the political agenda, resulting in more legislation and policies. The most significant advancement was the adoption of the 2013-2025 National Climate Change Strategy in 2012. Representing a milestone in climate policy, the strategy widened the government's approach to climate change by proposing actions that combine measures of adaptation and mitigation with the development of a low-carbon economy. The strategy provides a policy framework for climate priorities identified at sector, provincial and district levels.

The 2011–2014 National Poverty Plan identifies climate issues as one of the obstacles for the country's economic development and includes measures to reduce disaster risks and to adapt to climate change. These measures include the promotion of a strategy to reduce emissions from deforestation and forest degradation, to control wildfires, and to promote reforestation; the promotion of agriculture conservation and the diversification of income sources in areas prone to natural disasters; the establishment, training and equipment of local risk management committees in areas prone to natural disaster or vulnerable to climate change; making natural resource management committees operational; and the promotion of a programme for reforestation and reducing emissions from deforestation and forest degradation and establishing carbon stocks (REDD+).

The need to adopt measures to tackle climate change was later endorsed by The Five-Year Government Plan (PQG), launched in 2010. Mitigation and adaptation to climate change are considered strategic objectives of the Plan, guiding governmental policies from 2010–2014. The plan intends to approach climate change in association with economic development and poverty reduction. Details on how to achieve these strategic objectives are not presented, but the Five-Year Plan points out a list of general measures to improve environmental protection and address climate change, such as the promotion of environmental management addressing forest fires, soil erosion and recovery of arid areas, all of which involve applying climate change adaptation technologies.

Climate change mitigation and adaptation measures generally fall under the authority of the Ministry for the Coordination of Environmental Affairs (MICOA); although climate-related disaster risk management, prevention, and mitigation are all considered inter-ministerial issues.

With regards to the energy sector, the Council of Ministers approved the National Biofuels Policy and Strategy in 2009. The instrument aims to contribute to energy security and sustainable socio-economic development and energy security, by developing a biofuel sector. The document provides a general framework and guidelines for increasing activities in the sector; the policy and strategy adopts several measures for the promotion of biofuel production, adopting sustainability criteria, as well as limits for land allocation to the be exploited by the sector. The resolution establishes an institutional framework and a chronogram for the gradual increase of biofuel production and distribution and proposes the adoption of a Biofuels Development National Programme.

The 2011- 2025 Renewable Energy Development Strategy was adopted by the Ministry of Energy to establish core guidelines and success indicators for the development

of the sector. Actions target energy security and efficiency, increasing financing for new energy sources, including solar photovoltaics, wind, hydropower, and biomass. The strategy calls for the adoption of fiscal benefits and credit for the production of renewables, emphasizing that projects in these areas are potentially eligible for benefits from the Clean Development Mechanism (CDM).

Adaptation

Mozambique's First National Communication identifies seven sectors particularly vulnerable to climate change: agriculture; forests and pastures; livestock; water resources; coastal areas and resources; infrastructure; and health and fishing. The National Communication further outlines two adaptation pathways: (i) integrating environmental concerns with socio-economic development and (ii) sustainably managing natural resources across sectors.

As a Least Developed Country in the UNFCCC, Mozambique elaborated a National Adaptation Programme of Action (NAPA) in 2007, identifying the most vulnerable areas to climate change, and proposing immediate actions to promote adaptation to these urgent issues. The NAPA proposes four adaptation initiatives which include: (i) strengthening an early warning system; (ii) developing capacities of agricultural producers to cope with climate change impacts by reducing soil degradation due to inappropriate agricultural practices; (iii) reducing climate change impacts in coastal zones via dune erosion control and mangrove restoration; and (iv) improved management of water resources through updated water infrastructure and establishment of water sharing agreements.

In 2010, the government also adopted the Strategy and Action Plan on Gender, Environment and Climate Change. The plan aims to improve women's and poor communities' participation in climate change mitigation and adaptation interventions, but also foster their engagement in environment management.[38]

The Government of Mozambique has taken many steps to organize an institutional approach to environment conversation and climate change mitigation (detailed of laws are in the annex). At the national level, these actions include plans, strategies, regulations, and the creation of specialized lending facilities.

At the local government level, the City of Beira has also produced a series of strategic plans and policies.

Laws, Regulations, Policies and Strategic Plans Governing the Environment

National Level

- 2007 National Adaptation Program of Action
- 2011 Present Pilot Program for Climate Resilience (PPCR)
- 2012 National Strategy for Climate Change Adaptation and Mitigation (ENNAMC)
- 2013-2013 Action Plan for the Green Economy (PAEV)

City Level

- 2015 Beira Green Infrastructure Plan
- 2016 Beira Climate Change Adaptation General Plan

1.6 Public Finance

Public finance in Mozambique has three main elements: (i) National Government, (iii) Local Government, Municipalities or Districts, and (iii) State Owned Entities and Utilities.

1.6.1 National Government

The majority of revenues collected by the national government are from: (i) taxes on trade including customs tariffs, levied at transport hubs such as border roads, seaports and airports, and (ii) royalties from natural resource-based business enterprises such as coal, gas, logging, heavy and precious metals. Combined tax revenues in 2014 amounted to MZN 111.5 billion

Table 1.8 Approced Taxes and Fees

Tax Revenue	Non-Tax Revenue
• Municipal Individual Tax • Municipal Recurrent Property Tax • Municipal Property Transaction Tax • Municipal Vehicle Tax	• Improvements Contributions • Levies on Granted Licenses and on Economic Activity • Tariffs and Levies for Provision of Services

and are the basis for funding new infrastructure development and services delivered by the national government, and also the fiscal transfers that support municipalities and utilities.

1.6.2 Municipal Government

The municipal finance system in Mozambique is based on the core concept that municipalities should function like autonomous private enterprises. In this format, municipalities must achieve a balanced budget each year.

"Autonomous", however, is used as a general term since there are numerous regulations that limit the activities and decisions of municipalities including revenue collections, taxes and fee that can be levied, but also the type and amount debt that can be borrowed.

In terms of municipal revenue, Law 1/2008, the Law of Municipal Finance, defines the financial, budgetary and wealth regimes of the municipalities and reformulates the Municipal Tax System instituted initially by the Law 11/97.[39]

Under provisions of Law 1/2008, the Municipal Tax System includes the following approved taxes and other charges presented in Table 1.8.

The essential elements of each of the taxes, which integrate the Municipal Tax System in the country, are presented below.

Individual Municipal Tax

The annual poll tax is similar to the Tax on National Reconstruction. It is collected as a state tax outside the municipal areas and applied to national and foreign persons residing in the respective municipality aged between 18 and 60 years old. The persons must meet the circumstances of occupation, ability to work and the other conditions established in the Code.

The annual value of the Municipal Individual Tax is determined in accordance with the highest national minimum salary in force on 30 June of the preceding year. The tax will be applied through the rates of 4%, 3%, 2%, and 1%, depending on the classification of the different municipalities (levels A, B, C, and D, respectively,).

Municipal Recurrent Immovable Property Tax Applicability

The Municipal Recurrent Immovable Property Tax applies to the assessed property value of urban buildings in the respective municipality. Urban building means any land plot including buildings and constructions incorporated or built on them under permanent condition if:

- They are part of the assets of individuals or corporations for whom it may be imputed the respective use and benefit without the payment of a rent;
- They are susceptible in normal conditions, to generate income and are dedicated to any activity other than agriculture, forestry, or livestock.

For these purposes:

- Permanent condition of the buildings and existing constructions means buildings (even movable by nature), that have non-temporary objectives and are in the same location for a period longer than six months;
- In a regime of horizontal property or other form of condominium, each autonomous fraction will be defined as a building.

The taxable persons are the holders of the property rights on 31 December of the year prior to the year of collection. It is assumed that the persons who have registered the property in their name, at the property registrar may have possession of the property by any means at that date.

Exemptions

Newly constructed urban buildings in the parcel defined for dwelling are exempt for a period of five years counting from the date of the dwelling license.

Applicable Rates

The rates of the tax are 0.4% and 0.7%, depending when dealing with buildings for residence or any other purpose, respectively. The Municipal Property Tax rates apply on the asset value of buildings.

Levy on Economic Activity

In the terms of the Municipal Tax Code still in force, the rate for economic activity assumes the nature of "license of open door". The levy is due on any activity of commercial or manufacturing nature, including the supply of services, in the municipal territory once it is exercised in an establishment.

Under same code, the levy for economic activity is applied in relation to each establishment and is due for a determined amount, graduated in relation to the following factors: the nature of the activity undertaken; the location of the establishment; and the occupied area.

The powers of the Municipal Assembly are:

- To deliberate in matters of typology of the establishments subject to levy. This considers the factors mentioned above as well as the specific mechanisms for issuing and inspecting the corresponding levy.
- To determine the rates to be in force each year on dependence of the above-mentioned criteria. This cannot exceed the maximum of twenty times the monthly value of the national minimum salary for workers in manufacture per establishment.

This levy does not contain any of the essential elements of a "levy" and because it does not correspond to a direct service or activity provided by the municipal administration it is included in the current Municipal Tax Code.

The payment of levy for economic activity does not affect the collection of licenses for the exercise of the respective activity (alvarás) legally established in other regulations or the imposition of the convenient fees for services by the presentation of petitions of any nature to the municipal administration or due by the granting of licenses.

Municipal Tax on Vehicles

This tax substituted the corresponding State tax in the municipalities and entered into force through the publication of the Municipal Tax Code, approved by Decree 63/2008, dated of 30 December.

This tax will apply to the owners of the cars subject to the tax. This will be individuals, corporations, public or private entities residing in the respective municipality, presuming that the name on which the license and registration were issued is the owner, unless proved otherwise.

Municipal Sisa

The Municipal Sisa substituted the corresponding State tax in the municipalities and entered into force through the publication of the Municipal Tax Code, approved by Decree 63/2008, dated of 30 December.

It applies to the transfer (for consideration) of the right of property, or shared right, on immovable properties located in the municipal territory, to be paid by the acquirer.

Improvements Contributions

Established in Law 1/2008 and still to be regulated, it is an innovation in the Mozambican tax legislation in the post-Independence period (remote examples of the enforcement in the colonial period in the city then called Lourenço Marques).

The Improvements Contributions is defined as a special contribution to the undertaking of public works that add value to the real state. The Contributions will have as a total ceiling the expenditure actually incurred and as an individual ceiling the benefit that will result from the public work for each benefited property.

The launch may take place when the buildings located in the respective area of influence benefit from the following public works directly or indirectly executed by the municipality:

- Opening, enlargement, illumination and tree plantation on squares or streets;
- Construction and expansion of parks and gardens;
- Works to improve the beauty of the landscape in general.

The taxable person for Improvement Contributions is the owner or person in possession of the property who benefits from the work. The following requisites shall be observed for the respective assessment:

- The initiative to undertake the public works will come from the municipality, or from at least two thirds of the owners of the immovable properties located in the zone of influence of the public work to be undertaken;
- If the initiative for public work comes from the municipality, the plan of the works shall have to have the prior agreements of at least two thirds of owners of the buildings benefiting from the works;
- The improvements contribution shall be calculated by considering the expenditure incurred for the work that will be shared by the benefited properties, with the possibility of having a maximum of twelve partial payments;
- At taxpayer that pays the improvements contribution in a single payment will benefit from a discount of 15 percent on the total value of his contribution.

Street and recreational public open spaces, paving, simple paving repairs and repaving, alteration of the geometry of the roads and public open spaces, placement of guides and gutters are excluded from the Improvements Contribution if undertaken by the municipality and directly benefit the adjacent properties.
No borrowing allowed, except for occasional liquidity loans

In terms of borrowing, the rules are not as explicit, but in practice municipalities can only take short-term liquidity loans to cover budget shortfalls for a single year. Municipalities cannot take long-term loans to fund new infrastructure development or to annually fund operational costs without approval by national government. As of 2018, only the cities of Nacala, Maputo and Matola have been approved to take long-term loans to support capital expenditures. However, these have been limited cases for specific and unique projects.

Independent of taxes, fees and borrowing limitations, municipalities are also dependent on fiscal transfer from the national government derived from general tax revenues and grants managed at the national level.

A final key component of revenues for both local and national government is financial support from international donors. As for the CMB, fiscal transfers are further challenged due to the lack of consistency in the approval process. Currently, the annual amount of fiscal transfer is determined by the national government. There is no formula based on population, land use or other specific criteria. The only general guidelines are the amounts received in prior years. This makes the financial planning difficult and concerns banks that might consider long-term debt lending.
The small size of municipal budgets also limits

their role in the infrastructure and services sectors to operations only as capital expenditures exceed their financial capacity. Infrastructure development activities are therefore led by the national government or utilities. Even if CMB was able to double their revenues and expended 100 percent of their budget on capital programs, they would only have enough to fund an additional USD 20 million worth of infrastructure projects. A useful indicator of "borrowing capacity" is that interest payments on long-term loans should not exceed 7 percent of revenues.

Levies on Licenses

Municipalities may collect license fees on:

- Construction of infrastructure and simple equipment;
- Concession of licenses for land development, execution of private construction works, occupation of a public place due to construction works and to the utilisation of the buildings;
- Use and exploitation of the municipal land;
- Occupation and utilisation of the public space under municipal administration and utilisation of public assets;
- Supply of services to the public;
- Occupation and utilisation of reserved locations within markets and fairs;
- Authorisation of informal markets in the public streets and sites;
- Control and inspection of weights, measures and measuring devices;
- Car parking in parks and other sites reserved for that purpose;
- Authorisation for the use of advertising for social propaganda;
- Utilisation of any installations of public comfort, convenience or recreation;
- Performing burials, concession of plots and use of vaults, bone-vault and other installations in cemeteries maintained by the municipality;
- Sanitary licensing of installations;
- Any other license granted by the municipalities, which is not exempted by law;
- Registrations determined by law.

Tariffs and Levies on Provision of Services

Municipalities who provide a public service under their direct administration in the following cases may apply tariffs and levies on services:

- Water and electrical energy supply;
- Garbage collection, disposal and treatment, and sewage connection, conservation and treatment;
- Collective urban transportation of persons and goods;
- Utilisation of slaughterhouses;
- Maintenance of gardens and markets;
- Maintenance of streets.

The determination of the tariffs to be charged is the responsibility of the municipal assembly, on a cost recovery basis whenever possible.

Revenue collection and tax avoidance issues [40,41]

A substantial portion of the revenue potential of Beira's tax base remains unexploited, leading to large amounts of forgone revenue each year that could be used for development purposes.

Various issues with respect to revenue collection for public services will be explored throughout this report; they range from non-payment of utility bills to illegal network connections to poor management of records and billing information.

To reiterate, major instruments for municipal revenue collection are the following:
In addition to service tariffs for utilities, general tax and non-tax revenue sources include: [42,43]

- Individual Municipal Tax (IPA) – functionally speaking, a poll tax collected at the state level on both citizens and foreign residents between the ages of 18 and 60. Criteria for application consider occupation and ability to work. Tax rate is variable by municipality.
- DUAT fees, paid during the application process for obtaining legal rights for land usage and property development
- Municipal Recurrent Immovable Property Tax (IPRA) – a property tax that is applied as a proportion of assessed property value;

the rates are 0.4 percent for residential buildings, and 0.7 percent for all others.
- Levy on Economic Activity (TAE) – a tax applied to any commercial, manufacturing, or service transaction.
- Municipal Tax on Vehicles (IASV) – a tax applies to privately owned vehicles.
- Municipal Sisa (IASISA) – a tax applied to any transaction involving the transfer of property rights, to be paid by the acquiring party.
- Improvements Contributions – a tax levied on imputed increase in property value as result of public works projects in the vicinity of the property.
- License fees
- Tariffs on the provision of publicly-managed services and utilities

The cited report by Chimunuane et. al. (2010) analyzes seven major tax revenue instruments in order to estimate the amount of revenue forgone by CMB each year.

At the time the analysis was conducted, Chimunuane et. al. (2010) estimated that the revenue potential of these instruments was in fact 7.76 times greater than what was actually collected by the municipality, and that the full estimated potential of these instruments was equal to 87.1 percent of the total revenue collected by the muncipality in 2009.

There are likely several reasons for this poor level of revenue collection, some fixable and others not. Greater investment in records and information management technology, and oversight and enforcement mechanisms would better allow the municipality to track, monitor, and log economic activity related to businesses and markets, property development, vehicle operation, and land usage for residential purposes, and to successfully levy taxes and fees against the appropriate party. Greater effort needs to be put into the formalization of informal markets, especially those related to housing and agriculture, so that the state is better able to track economic activity.

No borrowing allowed, except for occasional liquidity loans

In terms of borrowing, the rules are not as explicit, but in practice municipalities can only take short-term liquidity loans to cover budget shortfalls for a single year. Municipalities cannot take long-term loans to fund new infrastructure development or to annually fund operational costs without approval by national government. As of 2018, only the cities of Nacala, Maputo and Matola have been approved to take long-term loans to support capital expenditures. However, these have been limited cases for specific and unique projects. Independent of taxes, fees and borrowing limitations, municipalities are also dependent on fiscal transfer from the national government derived from general tax revenues and grants managed at the national level.
A final key component of revenues for both local and national government is financial support from international donors. As for the CMB, fiscal transfers are further challenged due to the lack of consistency in the approval process. Currently, the annual amount of fiscal transfer is determined by the national government. There is no formula based on population, land use or other specific criteria. The only general guidelines are the amounts received in prior years. This makes the financial planning difficult and concerns banks that might consider long-term debt lending.

The small size of municipal budgets also limits their role in the infrastructure and services sectors to operations only as capital expenditures exceed their financial capacity. Infrastructure development activities are therefore led by the national government or utilities. Even if CMB was able to double their revenues and expended 100 percent of their budget on capital programs, they would only have enough to fund an additional USD 20 million worth of infrastructure projects. A useful indicator of “borrowing capacity” is that interest payments on long-term loans should not exceed 7 percent of revenues.[45]

1.6.3 Historical Budgets

The net income statements of the national and local governments, and state-owned enterprises and utilities are frequently negative, demonstrating the poor financial conditions and unsustainability.

Table 1.9 Estimates of Tax Revenue Potential in Beira[46]

Source of income	Ratios of			Efforts	Potential		The Base Year
Description	The ratio of compliance (RCu)	The ratio of application (RA)	Coverage Ratio of vineyard (RCA)	Results of the (ET)	%	Unused potential (PNU)	Income Raised (R)
	%	%	%	%	%	MT	MT
1. IPA	17.4%	37%	100%	6.5%	From	6,786,652	437,820
2.IPRA	45.0%	20%	35%	3.2%	96.9%	258,995,619	8,158,362
3.IASISA	50.0%	40%	85%	17%	83%	19,200,00	3,264,000
4.IASV	85%	100%	60%	51.0%	49.0%	10,282,619	5,249,137
5.DUAT	90%	90%	80%	64.8%	35.2%	17,206,421	11,149,761
6.TAE	81%	56%	100%	44.8%	55.2%	13,563,000	6,078,518
7. Markets	85%	75%	67%	42.6%	57.4%	25,735,927	10,975,822
Overall potential as a % of Revenue 1-7 (2009)				12.88%	87.1%	351,769,973	45,313,420
Overall potential as a % of own revenue (2009)				25.87%	74.1%	351,769,973	90,991,309
Potential/Expenditure %							Costs (2009)
Overall potential as a % of current expenditure 2009					206.7%	351,769,973	170,175,236
Overall potential as a % of the capital expenditure 2009					999.4%	351,769,973	35,196,972
Overall potential as a % of total expenditure 2009					171.3%	351,769,973	205,372,208

1.6.3.1 National National Budget

Table 1.10 Government of Mozambique National Budget (Billions)[47]

One Items	2012	2013	2014	2015
GDP	433	482	536	591
Total Revenue	94.8	126.6	146.4	151.0
% of GDP	21.9	26.3	27.3	25.5
Tax Revenue	80.9	107.6	125.2	128.6
Total Expenditure & Net Lending	**133.1**	**164.2**	**225.8**	**218.2**
Current Expenditure	78.3	92.6	127.4	122.3
Capital Expenditure	50.4	61.6	80.3	84.6
Unallocated Amounts	-0.4	-0.5	-1.9	0.0
Net Fiscal Position, before grants	**-38.7**	**-38.1**	**-79.4**	**-67.2**
Grants Received	21.9	24.9	22.7	28.7
Project Support	13.3	18.5	14.7	20.7

1.6.3.2 Municipal Council of Beira

Aggregate revenue and expenditures are described in Table 1.10.

Table 1.11 Beira Municipal Government Budget (MZN)

Items	2012	2013	2014
Revenue	756,134,574.64	782,849,071.27	793,142,061.12
Current Revenue	514,248,201.93	596,061,613.43	642,390,976.57
Revenue from Capital	241,886,372.71	186,787,457.84	150,751,084.55
Expenditures	**756,134,574.65**	**782,849,071.27**	**793,142,061.12**
Operation Costs	334,110,201.94	392,311,748.91	366,441,545.59
Capital Expenditure	422,024,372.71	390,537,322.36	426,700,515.52
Net Fiscal Position	**(0.00)**	**(0.00)**	**(0.00)**

1.6.3.3 EDM (Power)

Table 1.12 EDM Budget Statement – National (MZN)[48,49]

Items	2012	2013	2014
Revenue	7,352,388,971	8,495,613,933	9,913,415,208
Cost of Sales	(2,460,513,712)	(2,791,670,628)	3,542,568,207
Net Revenues	4,891,875,259	5,703,943,305	6,370,847,001
Personnel Expenses	(1,391,462,519)	(1,693,434,352)	(1,787,770,680)
Third Party Supplies & Services	(1,472,902,015)	(2,038,779,397)	(2,131,860,960)
Depreciation & amortization	(1,385,527,781)	(1,421,696,912)	(1,980,736,464)
Impairment losses	-	-	(1,782,967)
Provisions	(248,390,486)	(306,951,641)	(339,506,307)
Losses from reduction of fair value	-	-	(1,091,516)
Other Income and operating expenses (Net)	174,859,143	123,856,873	241,171,939
Operational Results (Net)	**568,451,601**	**366,937,875**	**369,270,046**
Financial Income (Net)	253,742,661	(67,652,072)	(317,013,069)
Income Taxes	(184,671,152)	(194,761,993)	(120,436,744)
Net Earnings	**104,583,810**	**637,523,110**	**(68,179,767)**

*Table Notes: Each bolded line item represents the net sum of the preceding line items

1.6.3.4 PAG AO Beira (Water)

Table 1.13 AO Beira Budget (MZN

One Items	2015
Revenue	309,029,334.00
Donations	7,500,000.00
Expenditures	231,392,497.00
Net	**77,636,837.00**

1.6.3.5 SASB (Sanitation)

SASB has three types of revenues sources that cover six types of expenditures. The organization runs a net budget deficit that is likely covered by general revenues managed by the municipality.

Table 1.14 SASB Budget (MZN)

Items	2015	2016 (Jan-Aug)
Revenue	**17,565,374.08**	**12,606,168.13**
Wastewater Sanitation Rate	13,214,533.07	9,161,245.25
Sewer Cleaning Service	2,316,755.77	2,530,965.00
Misc. (Taxes, Fines, Other Services)	2,034,084.06	942,857.88
Expenditures	**30,705,727.63**	**17,141,855.95**
Wages & Salaries	11,555,535.37	8,154,002.98
Fuels & Lubricants	2,333,429.14	1,595,121.60
Machinery & Equipment	5,303,416.31	365,960.30
Maintenance and Repair of Equipment	2,436,267.10	1,362,073.90
Other Services	1,811,407.56	2,684,291.52
Misc. (Safety & Insurance; Misc. Office; Utilities; Constructions)	7,265,672.15	2,980,405.65
Net	**-13,140,353.55**	**-4,535,687.82**

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Chapter 2

Financing Needs

Estimating the financing needs for cities is a complex task even in developed countries. It is even more difficult without conducting exhaustive and targeted surveys, particularly given that there are multiple points of view regarding financing needs.

For this assignment, the analysis will be broken into three categories: (a) financing needs to improve the living situation of the existing population and inhabitants, (b) financing needs to accommodate the future growth of the population, and (c) financing needs to respond to climate change through adaptation and resiliency measures and to support environmentally sustainable economic growth.

In section two, the financing needs to respond to unmet current and future demand for infrastructure and public services will be discussed. The financing needs to respond to climate change will be partially addressed in this chapter, and further discussed in section three.

Household Expenditure Data

In order to conduct the analysis, the census and INE's 2014/15 family budget survey data concerning urban households will be the key data sources used to quantify the demand, and per-unit cost estimates will be used to estimate the total financing needs for infrastructure improvements. The following household expenditure data is for Beira is derived from this survey:

Table 2.1 Household Expenditure by Quintile (Current Meticals)
Estimated based on avg. household size of 5.3 persons)[50]

Year	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Quintile 1,2,3 Avg.	National Average
2008/9	1176.60	1966.30	2570.50	3429.10	7881.10	1904.47	3404.72
2014/15	2263.10	3937.90	5925.40	9412.80	29213.60	4042.13	10150.56

Table 2.2 Structure of Monthly Expenditure Per Capita in Divisions of Spending by Population Quintile - Proportion of Total[51]

Division Expenses	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	National Average
Total	100	100	100	100	100	100
Non - Food Products a	62.5	58.6	51.6	39.8	14.4	35.6
Beverages Alcoholic	0.7	0.8	0.7	0.7	0.6	0.6
Clothing and Footwear	5.6	6.3	7	6.5	5.3	6
Housing, water, electricity	19	18.6	19.4	23.7	32	25.4
Furniture, furnishings,	2.7	3.1	3.6	4.1	5.6	4.4
Cheers	0.5	0.4	0.4	0.4	2.5	1.3
Transport	2.3	3.4	5.1	7.9	15.9	9.7
Communications	2.1	2.7	3.5	4.4	5.1	4.1
Leisure, Recreation an	0.4	0.5	0.7	1	1.7	1.1
Education	0.1	0.2	0.2	0.7	2.2	1.1
Restaurants, Hotels an	3.7	4.7	6.5	8.8	11.2	8.4
Goods and Services	0.5	0.8	1.3	2	3.5	2.3

Table 2.3 Suggested Breakdown of "HOUSING MIX" Expenditure Category

Category (Year)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	National Average
HOUSING	**13.02%**	**13.02%**	**13.80%**	**16.68%**	**22.56%**	**15.82%**
2008/09	153.19	256.01	354.73	571.97	1,777.98	622.78
2014/15	294.66	512.71	817.71	1,570.06	6,590.59	1957.15
WATER	**4.34%**	**4.34%**	**4.60%**	**5.56%**	**7.52%**	**5.27%**
2008/09	51.06	85.34	118.24	190.66	592.66	207.59
2014/15	98.22	170.90	272.57	523.35	2,196.86	652.38
POWER	**4.34%**	**4.34%**	**4.60%**	**5.56%**	**7.52%**	**5.27%**
2008/09	51.06	85.34	118.24	190.66	592.66	207.59
2014/15	98.22	170.90	272.57	523.35	2,196.86	652.38

Demographic Considerations

The census, last conducted in 2007, includes information on total population, household size, education, age, employment, housing conditions, and access to infrastructure aggregated at the Beira city level. The Family budget survey data, which includes comparative data from 2008-09 and 2014-15, includes information on expenditure patterns on housing, infrastructure services, food and goods aggregated at the national and provincial level as well as the urban and rural level and by quartiles. For the purposes of estimation, this report will use a 2017 city population estimate of 610,000 residents.[52]

To estimate future financing needs beyond the current demand gap, we will estimate future demand for infrastructure and services based on low, medium, and high rates of urbanization. The Beira Master Plan 2035 projects low, medium and high annual rates of population growth outward from the 2007 census (population: 443,369) of 2.25 percent, 3.25 percent and 4.25 percent respectively, which by 2035 would result in a lower bound population estimate of 827,000, a mid-range population estimate of roughly 1,000,000, and an upper bound population estimate of 1,422,000.

2.1 Financing Needs for Housing

As described in section 1.4, the quantity of housing stock in Beira is very poor. The majority of upper income residents live in a house made of cement block, while low-income residents most often live in a house made of wooden sticks that are filled with stone and clay paste (wattle and daub). Therefore, the analysis of financing needs will evaluate access to quality housing conditions and affordability. Quality housing conditions are defined as buildings constructed with cement block or brick walls; concrete, tile, or lusalite sheet roofing; and wood, marble, cement or tiles flooring.

Poor quality housing conditions are defined as buildings constructed with walls made of zinc sheets, adobe blocks, wood sticks, stones, clay paste, or solid waste materials; zinc sheets or grass roofing; and adobe or earthen flooring. These are the categories that are measured by the census data.

Affordability of Housing

Affordability is defined as households expending less than 30 percent of their annual incomes on housing. This is a general guideline used worldwide.

As it relates to demand for housing, national expenditure data is likely to be misleading. The national Family Budget Survey data (see tables 2.1, 2.2 & 2.3) estimates monthly household expenditure by quintile on a mixture of housing- and utility-related items. We estimate that of the expenditure in this category, 60 percent is spent specifically on housing. Based on this assumption, the data would suggest that the national average for monthly household expenditure on housing in the 2014-15 period was in the vicinity of MZN 1950. However, this statistic is not very useful for the purposes of determining affordability, as the average household expenditure on housing across the bottom three quintiles would in fact closer to MZN 550 per month, indicating a massive disparity in purchasing power that appears in the higher percentiles. We estimate the period average exchange rate (MZN/USD) for 2014-2015 at around 31 MZN/USD. This would indicate an annual average expenditure on housing for the bottom three quintiles at roughly USD 210 per household. A similar conversion of the cited estimate of the national average per-household expenditure on housing yields an average annual expenditure of USD 758. Another way we might assess housing demand in Beira is by perceived ability to pay, specifically by designating some allocation of monthly expenditure on housing as "affordable". This is a much more uncertain methodology because it assumes that money can reasonably be reallocated from other expenditure categories to housing, and that the current income allocation in poor households described in the Family Budget Survey does not already represent an effort at utility maximization for a given level of monthly income.

Beira, unplanned development[53]

Table 2.4 Household Expenditure Data by Quintile

Household Expenditures (2014/15)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	National Average
Monthly Total	13.02%	13.02%	13.80%	16.68%	22.56%	15.82%
(MZN)	2,263.00	3,938.00	5,925.00	9,413.00	29,214.00	10150.00
Monthly Total	294.66	512.71	817.71	1,570.06	6,590.59	1957.15
(USD)	73.00	127.00	191.00	304.00	942.00	327.00
On Housing, Est. Actual	51.06	85.34	118.24	190.66	592.66	207.59
(% Monthly Total)	13.02%	13.02%	13.8%	16.68%	22.56%	15.82%
On Housing, Est. Actual (MZN)	295.00	513.00	818.00	1,570.00	6,591.00	1,957.00
On Housing, Est. Actual (USD)	9.52	16.55	26.39	50.65	212.61	63.13
Housing Affordability Benchmark (USD)	21.90	38.11	57.34	91.09	282.71	72.11

Table Notes: The Housing Affordability Benchmark is considered to be 30% of total expenditure; assumes period average exchange rate of 31 MZN/USD for 2014

These figures are not particularly encouraging with regards to the ability of Beira's poorest residents to afford adequate housing without financial assistance. Even if households in the poorest three quintiles spent up to the affordability benchmark, they would on average have less than USD 500 per year to spend on housing. This level of expenditure would be likely to impose some level of financial hardship on these households while at the same time still not bringing within reach the USD 9000 single-family detached dwelling discussed in the next section.

A UN Habitat study referenced in the cited 2013 CAHF report estimates that the average Mozambican family invests around USD 15,000 into home improvements over the course of a lifetime, which would indicate some ability to pay for a home or home improvements on credit.[54] However, this lifetime expenditure barely exceeds our upper-bound cost estimate, and in any case, low-interest mortgage and general home loan products are largely unavailable for low-income residents.[55] Thus, low-income households are generally forced to make small repairs and improvements with whatever amount they are able to set aside from their monthly earnings.

All the above suggests that demand for housing in Beira is overwhelmingly for low-income housing options. Indeed, the Ministry for the Coordination of Environmental Affairs (MICOA) estimated that as of 2010, 70 percent of the city of Beira lived in informal housing (defined as housing, likely at least partially self-constructed, on un-zoned land and likely without the formal consent of the city).[56] The problem for Beira is that even the cheapest conceivable is still a major expense for the lowest end of the income distribution, and any substantially larger investment is likely to be firmly beyond the financial capacity of the vast majority of the city's residents.

2.1.1 Improving the Conditions for the Existing Population

Tables 2.5a-2.5c outline the quantity of individuals without access to quality housing conditions or affordability. This data is derived from a 2007 survey of the city of Beira conducted by the Istituto Nacional de Estatística (INE) ; the proportions contained in the table are then used in conjunction with out 2017 population estimate (610,000 residents, or 115,000 households based on an average household size of 5.3 persons)[58] to estimate

financing needs. Options for addressing the housing stock demand gap include in-situ improvement or total redevelopment. In terms of budgetary requirements, assuming no resettlement (which would likely require total reconstruction, even if some materials could be salvaged), the following is statistically estimated.

Based on the family budget survey data represented in Tables 2.4a.-c., it is statistically likely that only about 30 percent of Beira's current housing stock is adequate with regards to basic construction, which is broadly concurrent with the MICOA estimate cited in section 2.1 that roughly 70 percent of Beira's housing stock is informal. In Mozambique, the designation "informal" tends to refer to the quality of housing, and not necessarily to its legality; that is, per laws regarding the legal right to land usage, good faith occupation is sufficient for the legal usage of land for residential purposes. The designation "informal", therefore typically refers to homes constructed informally and, on an ad-hoc basis, and without official documentation certifying registered legal occupation of land as well as ownership of the structure on it (though such documentation is not strictly necessary for legal residence).

Costs of the individual components of construction are derived from two separate cost estimates. The lower bound estimate contained in Table 2.5 is for the use of locally available materials, such as stabilized soil block walls, and does not specify flooring and roofing materials.[59] The upper bound estimate is for a house built to international standards, using cement block walls, concrete floors, and corrugated metal roofing.[60]Both estimates are for low-cost, single-family detached dwellings.

Table 2.5 Housing Construction Material Typology[61]

WALL TYPE	HOUSEHOLDS	PROPORTION
Cement block	46,146	48.7
Brick block	6,516	6.9
GOOD QUALITY CONDITIONS	**52,662**	**55.6**
Wood/zinc	665	0.7
Adobe block	1.143	1.2
Caniço/sticks/Bambu/Palmeira	7,560	8
Woodpeckers maticados	31,694	33.4
Tin/card/paper/bag/Shell	463	0.5
Other	617	0.7
POOR QUALITY CONDITIONS	**42,142**	**44.4**

ROOFING TYPE	HOUSEHOLDS	PROPORTION
Concrete slab	8,789	9.3
Tile	240	0.3
Lusalite Plate	18,609	19.6
GOOD QUALITY CONDITIONS	**27,638**	**29.2**
Zinc Plate	56,063	59.1
Grass/culm/Palmeira	8,733	9.2
Other	2 370	2.5
POOR QUALITY CONDITIONS	**67,166**	**70.8**

FLOORING TYPE	HOUSEHOLDS	PROPORTION
Wood/parquet floors	7,023	7.4
Marble/granulito	265	0.3
Cement	66,929	70.6
Mosaic tiled floors/	1,801	1.9
GOOD QUALITY CONDITIONS	**76,018**	**80.2**
Adobe	11,660	12.3
No floor material	6,800	7.2
Other	326	0.3
POOR QUALITY CONDITIONS	18,856	19.8

Figure 2.1 Housing Conditions

19.8% Floors	80.2% Adequate Floors		
44.4% Walls	55.6% Adequate Walls		
70.8% Roof	29.2% Adequate Roof		
19.8% Total Rebuild	24.6% Two Updates	26.4% One Update	26.4% One Update

Table 2.6 In-situ Improvement Cost Estimates for Beira's Current Housing Stock

FLOORING TYPE	Proportion	Total Households	Average Cost per Household (USD)		Combined Total (USD)	
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Needs Floor	19.8%	22,770	300	3,000	6,831,000	68,310,000
Needs Walls	44.4%	51,060	800	4,000	40,848,000	204,240,000
Needs Roof	70.8%	81,420	600	2,000	48,852,000	162,840,000
New Unit	NA	NA	1,700	9,000	NA	NA
Total Expenditure	**NA**	**NA**	**NA**	**NA**	**96,531,000**	**435,390,000**

The estimate of total cost range to meet current housing need by in-situ improvement is therefore USD 96,531,000 to 435,390,000.

It is important to note that these cost estimates are specifically to update the city's substandard and largely informal housing stock by bringing it to minimum international standards. Additionally, the low-end cost estimates cited in the above table were derived from a study that explored methods for housing construction using locally available materials. Such con easily sourced and less expensive, may not meet international standards. Consequently, we recommend adhering to the higher bound cost estimate provided, which estimates the cost of the component parts of a small house built with cement flooring, concrete block walls, and a corrugated metal roof (and without a bathroom, kitchen, or any other amenities).[62]

It should also be noted that should the city

Table 2.7 Future Cost of Housing Development in Beira

2035 Population Estimate	Total Future Number of Households	Estimated New Households	Total Cost (USD), Single Family Detached	Total Cost (USD), Multi-story, Multi-unit
Lower Bound: 827,000	156,038	41,038	369,339,623	2,257,075,472
Middle Range: 1,000,000	188,679	73,679	663,113,208	4,052,358,491
Upper Bound: 1,422,000	268,302	153,302	1,379,716,981	8,431,603,774

Table notes: households are assumed to be 5.3 persons on average; current number of households in Beira estimated at 115,000

decide to meet any portion of the current demand gap via the construction of multi-story, multi-family developments for reasons related to the management and organization of urban space, that costs would be much higher. We estimate the cost of a modern, serviced dwelling in multi-unit project at USD 55,000 per unit. This substantially higher cost is likely due to greater requirements in terms of construction methods, engineering, materials, and specialized labor.

2.1.2 Accommodating the Future Growth

The Beira Master Plan 2035 projects low, medium and high annual rates of population growth outward from the 2007 census (population: 443,369) of 2.25 percent, 3.25 percent and 4.25 percent respectively, which by 2035 would result in a lower bound population estimate of 827,000, a mid-range population estimate of roughly 1,000,000, and an upper bound population estimate of 1,422,000.

Meeting the housing demand represented by this future population growth will require construction beyond the current demand gap described in the previous section. Accordingly, this section will estimate the additional expenditure required (for all new households beyond the current estimate of 115,000) for each growth scenario.

We estimate that the per-unit cost range for new housing ranges from USD 9,000 for a simple, single family detached dwelling to USD 55,000 per unit for multi-story multi-unit development. Unfortunately for Beira, the cheapest available options for meeting housing demand are basic, single family detached dwellings. While the construction of such housing might be a feasible strategy for meeting the current demand gap, it is unlikely that the city can consider such a strategy exclusively for meeting future demand that could potentially exceed an additional one-hundred-fifty thousand additional households without significant consequences in terms of urban sprawl and related costs (potential climate vulnerability, economic opportunity cost of repurposing agricultural land for housing, and costs associated with meeting demand for utilities, transportation and services).

Given these considerations, the city will likely be forced to consider options for construction of multi-story, multifamily dwellings, which are likely to significantly more expensive on a per-unit basis because of the greater design, engineering and construction requirements. This is not to say, however, that such an investment cannot be cost-effective relative to the construction of single family detached dwellings; any cost-benefit analysis should consider the economies of scale in the provision of modern utilities and services offered by consolidated housing relative to single family detached housing, and estimate the above listed costs associated with the urban sprawl for an accurate estimate of the relative cost tradeoff between the two types of investment.

The market segment in need of support is likely the 70 percent of the city previously identified as living in informal housing. Based on our household expenditure data, the remaining 30 percent of the city housed formally likely represents top portion of earners who are able to rent or buy, to whom local private developers already cater. These segments are not uniform; of the informally-housed 70 percent the

Table 2.8 Summary of Cost Estimates for Housing

Details	Cost Range Estimate
Cost estimate for meeting the current demand gap via improvement/construction of low-cost single family detached dwelling units. Approximately 70% of Beira's 115,000 households are estimated to be deficient in some aspect of construction	USD 96.5 million to 435.4 million
Cost estimate for meeting demand derived from the 2035 lower-bound population estimate (827,000 residents). This is an estimated 41,038 new dwellings.	USD 369.3 million to 2,257.1 million
Cost estimate for meeting demand derived from the 2035 mid-range population estimate (1,000,000 residents. This is an estimated 73,679 new dwellings.	USD 663.1 million to 4,052.4 million
Cost estimate for meeting demand derived from the 2035 upper-bound population estimate (1,422,000 residents). This is an estimated 153,302 new dwellings.	USD 1,379.7 million to 8,431.6 million

lowest-income households would likely require subsidized public housing, whereas middle-income households likely only require more formal low-income mortgage products greater development of low-income homes via public-private partnership in order to move from informal to formal housing. Within the formally housed 30 percent, an increased diversity of rental and moderately priced housing and finance options provided by the private sector would likely take some demand pressure off the middle segment of the housing market. It's not clear what proportion of the development financing requirements for housing would need to be provided by the federal or local governments.

2.2 Financing Needs for Transport

There is limited data on the access to quality transport services. The family budget survey suggests that low- and middle-income households spend very little on transport, in the range of 0 percent to 5 percent of annual income, which can be a misleading statistic. Unlike other sectors, households who expend nearly 0 percent on transport potentially means that they have no access to affordable transport services, and therefore solely rely on walking.

Alternatively, another method for evaluating the financing needs in the transport sector is based on existing road conditions and transport service providers. No data was available on existing road conditions or transport service providers, so the study will estimate using national statistics. Beira is well-connected to the surrounding region and is the origin of ocean-based commerce for central Mozambique. Beira is connected via arterial east-west and north south highways to the capital cities of Malawi, Zambia, and Zimbabwe. The 2010 World Bank "Making Transport Climate Resilient" report stresses that the key obstacle to an enduring robust road network in Mozambique is instead the ability of the state to provide ongoing maintenance. Institutional knowledge regarding the design and construction of climate resilient roads is apparently present.[63]

The report estimates that nationally, only 21 percent of Mozambique's roads are paved and that 11 percent of paved roads are in poor condition. Of the remaining unpaved 79 percent, fully half of those roads are estimated to be in poor condition. This report also suggests that measures to protect road infrastructure in areas such a Beira with relatively greater exposure to extreme weather events are necessarily dependent on larger coastal protection measures taken to protect city infrastructure more generally.

It is likely that issues with Beira's mass transit services mirror those of Mozambique's other large cities. With regards to mass transit services, the cited 2008 USAID Urban Transport Policy Proposal assesses that the

transportation service sector in Maputo, while currently not solvent, could become self-sustaining via an effort to capture economic gains from efficiency.[64] The report argues that the current unsustainability of the sector derives from the combined inefficiency resultant from using inappropriate and poorly maintained vehicles, and failing to properly allocate labor and designate routes. [65]The report proposes that value, rather than cost is the primary point of contention between service providers and customers; that is, heavy patronage is evidence of the affordability of the service, and resistance to tariff levels is instead a product of poor service quality.[66] Mass transit services in Beira should be assessed for similar problems.

While overhaul of the sector to address efficiency would likely address many of its current ailments, investment in capital assets (like buses and maintenance infrastructure) will still be necessary in order to fully realize efficiency gains.

2.2.1 Maintenance existing conditions / size road network

Using a geographic information system, we estimate that Beira currently has a road network of about 720 km. Only about 379 km2 (60 percent) of the administrative area is currently developed, leading to a road network density of 1.9 km of road per square kilometer of developed area. Additionally, we estimate the population density across this developed area is roughly 1609 people/km2.

Assuming that the condition of Beira's road network mirrors that of Mozambique's road network nationally (details in the preceding section), we can estimate the following with respect to total rehabilitation of the existing network.[67]

Additionally, we can suggest a likely cost range of updating Beira's estimated 569 kilometers of unpaved road, with the lower bound estimate being based on the cost estimates cited above. Beira has 180 km of secondary road, which can be updated at a minimum cost of USD 240,000 per kilometer, for a total cost of USD 43.2 million; and it has 388.8 km of tertiary road, which can be updated at a minimum cost of USD 200,000 per kilometer, for a total cost of USD 77.76 million. In total, we estimate a minimum cost of USD 120.96 million.

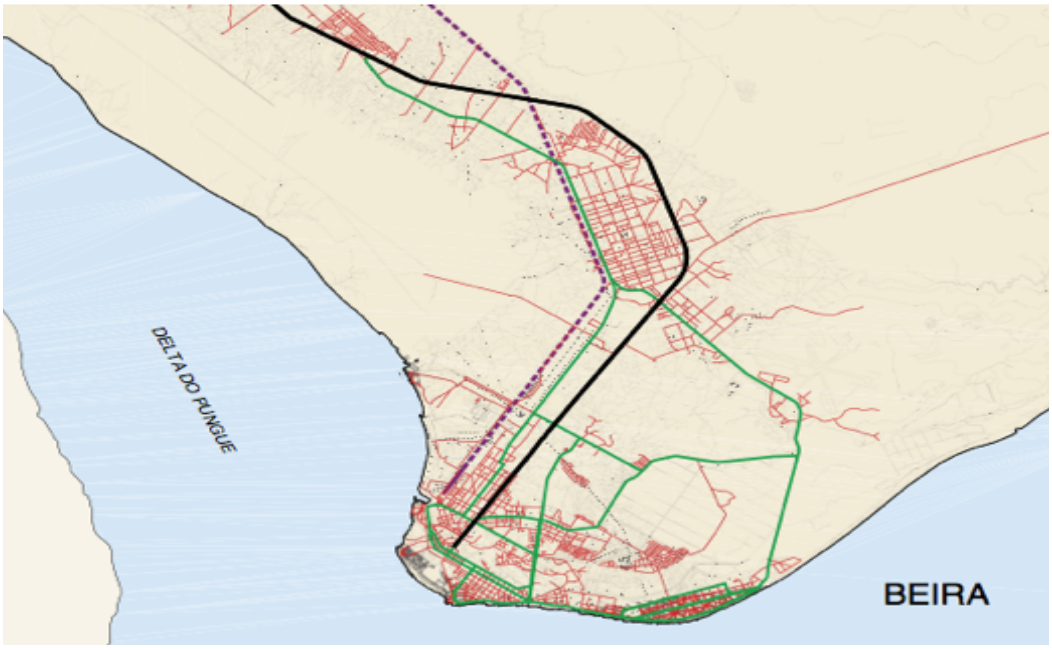
We can also construct an upper bound cost figure being based on an estimate for climate-robust construction offered in the cited report.[68] The previously cited "Making Transport Climate Resilient" report cites a per-kilometer construction price of USD 333,600 with an additional premium of up to 18.7 percent for climate-robust construction). Thus, 569 kilometers of unpaved road, upgraded at a cost of USD 333,600 per kilometer, and including a cost premium of 18.7% for climate-robust construction, can be expected cost in total roughly USD 225.3 million.

Additionally, we estimate the average annual cost of maintenance for the current road network over a 20-year period (which is the estimated time lapse between necessary rehabilitations) at USD 5.77 million.[69] This maintenance figure includes routine (annual) maintenance, periodic maintenance (every 8 years for paved segments; every 5 years for unpaved segments), and total rehabilitation (once every 20 years).

If Beira's current road network were updated such that it was entirely paved, the estimated average annual cost of maintenance of would increase to roughly USD 12 million.

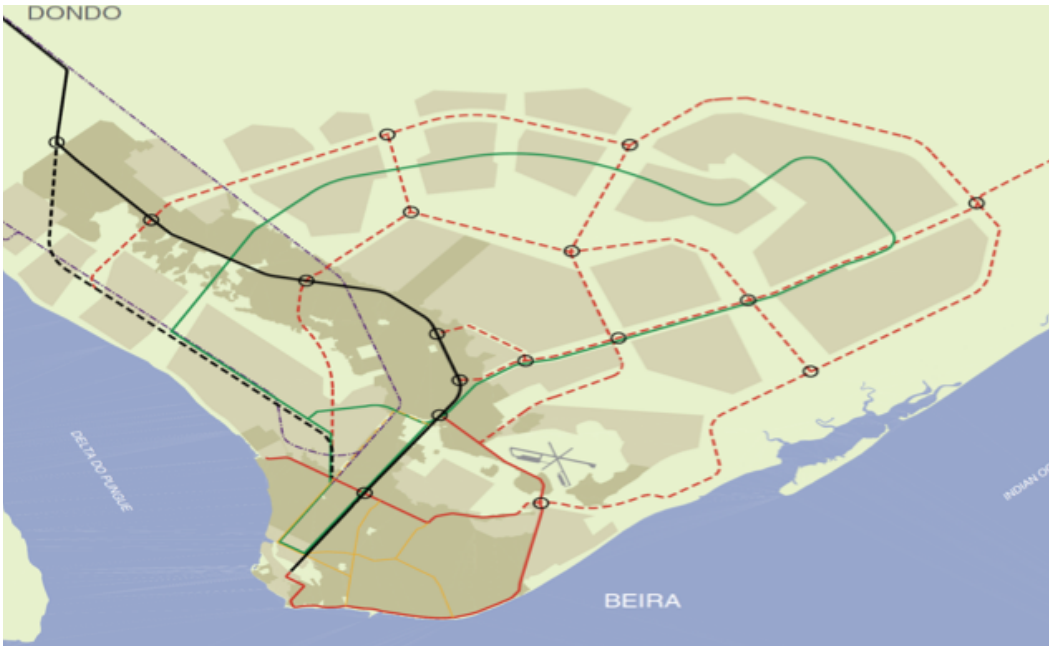
Based on the cited 2015 CMB municipal budget document, it appears as though the municipal authority spends only MZN 1.2 million (the equivalent of roughly USD 300,000 using a 2015 period average exchange rate of 40 MZN/USD) on road maintenance.[70] It is not clear how much assistance is received from the national government via National Roads Administration (ANE) project collaboration. Even taking into consideration local labor costs, this level expenditure is still certainly representative of a significant existing financing gap.

Figure 2.2b Approced Taxes and Fees



[71]van Weelden, "Masterplan Beira Mozambique," November 2013.

Figure 2.2b Proposed configuration of Beira's transportation network



[72]van Weelden, "Masterplan Beira Mozambique," November 2013.

Table 2.9 Rehabilitation Cost of Beira's Existing Road Network

Type	Proportion of Type	Paved - Total	Paved - Poor Condition	Unpaved Total	Unpaved - Poor Conditio	Cost of Rehab per km - Paved	Cost of Rehab per km - Unpaved	Cost of Rehab Total
Primary	115.2 km	115.2 km	12.7 km	0 km	0 km	300,000 USD/km	80,000 USD/km	3,810,000 USD/km
	16%	16%	8.4%	0%	0%	NA	NA	NA
Secondary	144 km	36km	3.9km	180 km	90 km	240,000 USD/km	50,000 USD/km	5,436,000 USD/km
	30%	5%	2.6%	25%	12.5%	NA	NA	NA
Tertiary	388.8 km	0 km	0 km	388.8 km	194.4 km	200,000 USD/km	25,000 USD/km	4,860,000 USD/km
	54%	0%	0%	54%	27%	NA	NA	NA
Aggregate	100%	NA	NA	NA	NA	NA	NA	14,106,000 USD/km

Table 2.10 Derivation of Average Annual Road Maintenance Costs for Beira

Type	Paved Total km	Unpaved Total km	Cost of Maintenance per km (USD), Paved		Cost of Maintenance per km (USD), Unpaved		Average Annual Maintenance Cost per km (USD)			
			Routine (Annual)	Periodic (8 yrs)	Rehab (20 yrs)	Routine (Annual)	Periodic (5 yrs)	Rehab (20 yrs)	Paved	Unpaved
Primary	115.2	0	1,100.00	55,000.00	300,000.00	1,500.00	35,000.00	80,000.00	21,435.00	10,450.00
Secondary	36	180	880.00	44,000.00	240,000.00	1,200.00	28,000.00	50,000.00	17,148.00	7,660.00
Tertiary	0	388.8	660.00	44,000.00	200,000.00	750.00	10,000.00	25,000.00	14,961.00	3,350.00

2.2.2 Expansion of existing network / capital

Assessing future transportation need is a difficult proposition. It must take into account both the road network density (i.e. kilometers of road per square kilometer) of city, as well as the city's population density (i.e. residents per square kilometer). For Beira, these figures are currently 1.9 km of road/km$^{\wedge}$2 and 1,609 persons/km$^{\wedge}$2.

Currently Beira has developed roughly 60 percent of its administrative area. This assessment will consider likely additional demand for transportation should future development remain at 60 percent of Beira's administrative area, or extend to 80 percent, or 100 percent of the administrative area. The following considerations are important to keep in mind:

- Extension of development to 100 percent of Beira's administrative area is not a broadly feasible scenario for various reasons – much of the undeveloped land is too climate-exposed to be usable for development purposes, and much of it is also prime agricultural land, making it a valuable economic resource. This scenario is considered merely to provide an upper bound cost estimate for the greatest possible extension of the road network.
- The population density of Beira likely must increase. The lowest population growth estimates we consider in this report projects the city's population growing by greater than 50 percent over the next twenty years. To maintain constant population density under this scenario, the city would have to develop close to 100 percent of its administrative area. We have detailed above why this is unlikely.

- Taking into consideration both the current ratio of population density to road network density, and likely levels of vehicle ownership, it is likely safe to say that traffic congestion is not currently a major concern for the city. However, it stands to become a concern should population growth approach high bound estimates and should the developed area of the city not increase to any substantial degree. Road network density does not have to increase in proportion with population density in order to properly manage traffic, but Beira should ideally still aim to provide greater road access per square kilometer in order to both increase connectivity and to ease transportation.

Various scenarios for meeting future demand for road access are detailed below. Each scenario assumes that newly-built portions of the road network will be paved and climate-robust (thus, they provide an upper-bound per-unit cost-of-construction estimate), and that primary, secondary, and tertiary roads will be built in the following proportions: 15% primary road, 30% secondary road, and 55% tertiary road. We will discuss the most important scenarios below:

1) In this scenario, the City of Beira expands in developed area to 80 percent of its total administrative area, and the city seeks to maintain a lower average road network density of 1.5 km/km2. This would require the construction of an additional 37.5km of road, at a projected construction cost of USD 11,056,875. This new portion of the network would require additional annual maintenance expenditure of USD 622,057.50 on average. This is the least expensive scenario that involves additional development.
2) In this scenario, the City of Beira expands in developed area to 80 percent of its total administrative area, and the city seeks to maintain its current average road network density of 1.9 km/km2. This would require the construction of an additional 239.5km of road, at a projected construction cost of USD 70.62 million. This new portion of the network would require additional annual maintenance expenditure of USD 3.97 million on average. We judge this scenario to be most likely.
3) This scenario represents an increase in road network density to 2.3 km/km2 (i.e. better service coverage) in conjunction with the expansion of the city to 80 percent of its administrative area. This would require the construction of an additional 441.5km of road, at a projected construction cost of USD 130.18 million. This new portion of the network would require additional annual maintenance expenditure of USD 7.32 million on average. Such an approach would provide greater connectivity in conjunction with a moderate expansion in the size of the city.
4) This highest-cost scenario projects (for the sake of analysis) urban sprawl to 100 percent of Beira's administrative area and an increase in road network density to 2.3 km/km2. This scenario would require the construction of an additional 731.3km of road at a projected construction cost of USD 215.62 million. This new portion of the network would require additional annual maintenance expenditure of USD 12.13 million.

There is heavy demand in Beira even for tertiary or vicinal roads. The Reall Beira Housing Market Study notes that many of the respondents to their housing development survey noted that informal access paths to their homes were barely passable during rainy season, and that roads that would be passable during periods of flooding would be of great utility.[73]

We additionally sought to provide some measure of service provision as it regards road network access by estimating a ratio of population density to road network density. Although quality of traffic management is likely a better indicator of chronic traffic congestion, this measure will at least provide some measure of potential traffic by indicating both residents and formal road construction per square kilometer. In this light, it is most useful to consider this ratio as a very rough measure of demand for road access per square kilometer: higher ratios indicate a population density that is high relative to a road network density; lower ratios indicate a population density that is low relative to road network density.

The ratio may also be considered as marker for financial sustainability; population density relative to road network density can shed light on the amount of potential revenues relative to average annual maintenance costs per kilometer of road. Ratios for each of the above scenarios evaluated for each population growth projection can be found in the table below.

It is useful to note that under most growth scenarios, the ratio of population density to road network density increases, often substantially. Feasibility studies should consider the implications of this increase with regards to the ability of municipality to reasonably afford additional maintenance costs necessitated by future road construction.

2.2.3 Rolling stock / Operations

In Beira, the transportation service sector is currently dominated by paratransit. Drivers derive income from service fees and pay owner fee for usage of vehicle. Affordability of services does not appear to be the primary issue, but rather cost relative to the quality of transport services. There does not appear to be a public transportation service provider in Beira.[74]

Affordability of Transportation Services

Affordability is also likely to be major concern with regards to the successful implementation of a public transportation option. A 2008 USAID Urban Transport Policy Proposal for Mozambique notes that fares in Maputo as of 2008 were set by policy to MZN 7.5 for trips up to 9km, and MZN 10 for trips up to 30km, although these rates were not implemented due to public protest. Absent any updated information, and considering the time elapsed since the publication of this report, we will assume for the purposes of analysis that these fare increases were eventually implemented. Additionally, in the last two rows of the following figure, we represent the expenditure required of a family making exclusive use of mass transit as a percentage of monthly expenditure. This is done in order to estimate the average financial burden that ideal expenditure on transportation would impose on a household in each quintile. In each case, the expenditure is derived from a scenario in which two adults make use of public transportation to travel both to and from work 5 days per week. The MZN 7.5 fare represents a short commute scenario, while the MZN 10 fare represents a long commute scenario.

Table 2.11 Ratio, Population Density/Road Network Density for City of Beira

Scenario	City Development Coverage		Road Network Density	2035 Population Estimate	Projected Population Density (Residents/km2)	Ratio (Population density to road network density)
	%	Km²				
1	80%	505	1.5	827,000	1,637.62	1,091.75
				1,000,000	1,980.20	1,320.13
				1,422,000	2,815.84	1,877.23
2	80%	505	1.9	827,000	1,637.62	861.91
				1,000,000	1,980.20	1,042.21
				1,422,000	2,815.84	1,482.02
3	80%	505	2.3	827,000	1,637.62	712.01
				1,000,000	1,980.20	860.96
				1,422,000	2,815.84	1,224.28
4	100%	631	2.3	827,000	1,310.62	569.83
				1,000,000	1,584.79	689.04
				1,422,000	2,253.57	979.81

Table 2.12 Affordability of Public Transportation Services

Household Expenditure (2014-2015)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Monthly Total (MZN)	2,263.00	3,938.00	5,925.00	9,413.00	29,214.00
Transportation (% of Monthly Total Expenditure)	2.3%	3.4%	5.1%	7.9%	15.9%
Transportation, Monthly Expenditure, Current MZN	52.05	133.89	302.19	743.61	4644.96
Transportation, Weekly Expenditure, Current MZN	13.01	33.47	75.55	185.90	1161.24
Weekly trips per household, MZN 7.5 fare	1.7	4.5	10.1	24.8	154.8
Cost of 2 adults traveling to/from work; Fare of MZN 7.5 (% of monthly household expenditure)	29%	17%	11%	7%	2%
Cost of 2 adults traveling to/from work); Fare of MZN 10 (% of monthly household expenditure)	38%	22%	15%	9%	3%

*Table Notes: Cost of 2 adults travelling to/from work assumes five two-way trips per week, or 86.7 trips per household per month on average

Table 2.13 Cost Estimates, Development of Beira's Rolling Stock

Population	Number of Buses required	Total Cost of Purchase (USD Thousands)	Avg. Annual Operation Cost (USD Thousands)			Avg. Annual Maintenance Cost (USD Thousands)		Avg. Annual Cost (USD Thousands) (Fleet operation & Maintenance)	
			Fuel	Labor	Total	Current	Target	Current	Target
2015 Current: 610,000	610	48,800.0	38,979.0	1,464.0	40,443.0	32,940.0	5,246.0	73,383.0	45,689.0
2035 Lower Bound: 827,000	827	66,160.0	52,824.6	2,012.1	54,836.7	44,658.0	7,145.3	99,494.7	61,982.0
2035 Middle Range: 1,000,000	1,000	80,000.0	63,875.0	2,433.0	66,308.0	54,000.0	8,640.0	120,308.0	74,948.0
2035 Upper Bound: 1,422,000	1,422	113,760.0	90,830.3	3,459.7	94,290.0	76,788.0	12,286.1	171,078.0	106,576.1

*Table Notes: Ideal ratio of buses is assumed to be 1 bus per 1,000 residents; Buses are estimated to cost USD 80,000 each; Annual fuel costs per bus estimated at USD 63,900; Annual operation costs per bus estimated at USD 2,400; Current annual maintenance cost per bus estimated at USD 54,000; Target annual maintenance cost per bus is USD 8,600

It is important to remember, as noted previously, that the small expenditures on transportation reported in the family budget survey by respondents in the lower quintiles may be to some degree indicative of the poor availability of services, and not wholly an indicator of willingness or ability to pay. However, it is safe to say that in each of the "ideal expenditure" scenarios it is likely that for the bottom three quintiles (and extremely likely for the bottom two quintiles), the prospective financial cost of consistent use of mass transit services far outstrips their ability to pay.

To summarize, demand for services in this sector is high; the Beira Housing Market Study noted that 40 percent of the respondents to their survey indicated that it takes them more than an hour to commute to their place of work. A 2009 FinScope country finance report on Mozambique estimated that only 5.3 percent of the urban adult population owned some type of motor vehicle.[77]

Assessing Financing Needs for Rolling Stock/ Operations

The situation in Beira is similar to that in Maputo,

*Key Estimated Figures: The following assumptions were made for the purposes of constructing the cost estimates contained in Table 2.13

Price of fuel for transportation:	MZN 35/Liter[79]
Labor Cost of Bus Operation:	MZN 200/day; MZN 73,000/year
Daily Hours of Operation:	12 Hours
Avg. Speed:	25km/h
Avg. Distance Covered	300km/day; 109,500km/year
Fuel Efficiency:	2km/liter
Avg. Fuel Usage:	150 liters/day; 54,750 liters/year
Breakdown Rate[80]:	Maputo (current): 1600 km/breakdown Target: 10,000 km/breakdown
Avg. Maintenance Cost:	1%; USD 800 per maintenance
Avg. Maintenance Frequency:	Maputo (current): 67.5/year Target: 10.8/year
Estimated Exchange Rate:	30MZN/USD

where there is a large private and informal sector that operates as a sort of taxi-bus service (these vehicles are called chapas).[78] Steady increases in fares, relative to poor service quality continues to be a major source of complaint. The informal sector operates according to demand and whether or not an operator can fill their vehicle with fares. The previously cited 2008 USAID study estimates that 1,000 full size buses would be required to adequately service a city of 1 million residents. With regards to the capacity of the informal sector, the study estimates that Maputo's public buses and 3,700 informal chapas provide the equivalent of about 700 city buses, likely only in terms of capacity and not quality of service.

This figure provides an easy benchmark for Beira, suggesting that the CMB likely would require about 610 full-size buses at present, and another 500 for every additional 500,000 residents. This figure can be adjusted according to population density and the city's layout based on if, or to what degree these considerations are likely to make coverage more or less difficult.

An important consideration of the study with regards to service provision involves maintenance. It is suggested that a properly maintained bus should be able to attain an operating mileage of, on average, 10,000 km before requiring maintenance. Data on Maputo's public transportation system are used below to construct high-end cost estimates; the corresponding "target" figures were provided in the 2008 USAID as ideal-scenario values. Based on these figures, we estimated the demand and financing requirements for public transportation vehicles in Beira.

As it regards public health, the report notes that Maputo's large informal transportation sector lacks any accountability mechanisms for dangerous drivers. It is suggested that the unregulated nature of the sector likely contributes to competition over a limited number of fares, which leads to aggressive and reckless driving.

In Beira, it is unclear what licensing or regulatory mechanisms are currently in place for private sector transit operators that would serve to regulate the number and quality of chapas on the road. Beyond allowing the city to obtain some control over safety, service, and efficiency, the capacity to register and regulate the city's public transit system would additionally allow the municipal authority to obtain accurate operations data that would assist in the determination of appropriate fares and operator wages, as well as in the collection of tax revenues.

In Maputo, it appears that a complex structure of taxation and subsidy, the nature of informal employment arrangements between vehicle owners and operators, poorly maintained vehicles, and inefficient service have all contributed to rising fares and widespread tax evasion.[81] Should Beira attempt to regulate and structure its own public and private transportation services market, it should avoid similar mistakes in order to minimize any economic loss due to inefficiency.

A summary of cost estimates with respect to infrastructure rehabilitation and expansion, and the establishment of a public transportation authority is provided below in Table 2.14.

Table 2.14 Summary of Cost Estimates for Transportation

Details	Cost Estimate For New Construction
Cost to rehabilitate the current road network (total length of 720 km, and average annual cost of maintenance.	Cost of Rehabilitation: USD 14.1 million Cost of Maintenance: USD 5.77 million
Cost to update (i.e. pave) 569 km of unpaved road; average annual maintenance cost of the current 720 km road network, assuming it is all paved	Update: USD 120.9 million to 225.3 millio Maintenance: USD 12 million per year
Cost of road network expansion assuming a road network density (RND): 1.5 km/km2; covering 80% of Beira's total land (37.5 km of new paved construction), and additional maintenance costs associate with this new road	Construction: USD 11.1 million construction Maintenance: USD 0.622 million per year;
Cost of road network expansion assuming a road network density (RND): 1.9 km/km2; covering 80% of Beira's total land (239.5 km of new paved construction), and additional maintenance costs associate with this new road	Construction: USD 70.62 million construction; Maintenance: USD 3.97 million per year
Cost of road network expansion assuming a road network density (RND): 2.3 km/km2; covering 80% of Beira's total land (441.5 km of new paved construction), and additional maintenance costs associate with this new road	Construction: USD 130.18 million construction; Maintenance: USD 7.32 million per year
Cost of road network expansion assuming a road network density (RND): 2.3 km/km2; covering 100% of Beira's total land (731.3 km of new paved construction), and additional maintenance costs associate with this new road	Construction: USD 215.62 million construction; Maintenance: USD 7.32 million per year
Cost estimate for meeting the current demand for public transportation demand. Population estimate of Beira is 610,000 residents	Vehicle Purchase: USD 66.2 million; 827 buses O&M Cost: USD 61.9 to 99.5 million per year
Cost estimate for meeting transportation service demand derived from the 2035 lower-b ound population estimate (827,000 residents).	Vehicle Purchase: USD 66.2 million; 827 buse O&M Cost: USD 61.9 to 99.5 million per year s
Cost estimate for meeting transportation demand derived from the 2035 mid-range population estimate (1,000,000 residents).	Vehicle Purchase: USD 80 million; 1,000 buses O&M Cost: USD 74.9 to 120.3 million per year
Cost estimate for meeting transportation service demand derived from the 2035 upper-bound population estimate (1,422,000 residents).	Vehicle Purchase: USD 113.8 million; 1,422 buses O&M Cost: USD 106.6 million to 171.1 million

*Note that "Maintenance" costs listed for expansion scenarios are in addition to current maintenance requirements

2.3 Financing Needs for Energy and Power

Includes (i) cooking, (ii) electricity, and (iii) transport. There is a large population that is reliant on low-cost but inefficient energy and power sources.

Multiple reports have noted that currently, the vast majority of the population uses wood and charcoal as their primary sources of energy. [82, 83] For the purposes of this study, we consider quality energy sources to be grid electricity, natural gas, or electricity from a household generator. We will consider solar energy a novel way of meeting demand for electricity in the Green Infrastructure Possibilities section of this report. We recognize that other power sources will be used on occasion for niche purposes, but this report assumes that power derived these sources should ideally be marginal when considered relative to the bulk of household power consumption.

Affordability Considerations in the Energy Sector

It will be additionally necessary to consider the expected long-run prices of grid electricity and other fuels (propane, natural gas, etc.) relative to the income of Beira's poorest residents when evaluating the ultimate financial sustainability of each type of power production method. Because grid electricity is likely to be the most consistently available, safe, and inexpensive (with regards to both consumption and maintenance of infrastructure) primary energy source, we will evaluate affordability below:

These figures indicate that grid electricity is likely a wholly affordable energy option for the third, fourth, and fifth quintiles. Additionally, with regards to the second quintile, it is not clear that the average monthly expenditure on electricity (although twice as large as the current average expenditure on energy for that quintile estimated from the family budget survey) is substantially greater than either willingness or ability to pay. It may be that greater access to quality energy sources would induce some households to consume relatively more, if the tradeoff between greater cost and greater convenience favors the latter. Finally, it is likely that affordability will be an issue for the bottom quintile, with the average electricity bill representing a 10 percentage-point increase over the current estimated average energy expenditure for that quintile. Because connection to the electricity grid does not completely substitute for all other forms of energy consumption, it will be important for the city of Beira to consider whether grid connections might in fact raise the overall energy bill of its poorest residents. Even if this is by consumer choice, it may still be useful for the city as a matter of routine to install pre-pay meters to help households budget their spending on grid electricity.

Additionally, the provision estimates provided in this report indicate that should the city strive to achieve total grid electricity coverage in both

Table 2.15 Affordability of grid electricity

Household Expenditure (2014-2015)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Monthly Total (MZN)	2,263.00	3,938.00	5,925.00	9,413.00	29,214.00
Power, Est. Actual (% of Monthly Expenditure)[84]	4.34%	4.34%	4.60%	5.56%	7.52%
Power, Est. Actual Monthly Expenditure, Current MZN	98.22	170.90	272.57	523.35	2,196.86
Avg. Monthly Electricity bill % of Monthly Expenditure	14%	8%	5%	3%	1%

*Table Notes: The national Family Budget Survey data estimates monthly household expenditure by quintile on a mixture of housing- and utility-related items. We estimate that of the expenditure in this category, 20 percent is spent specifically on energy. The average monthly electricity bill is estimated from a 2012 EDM statistical summary that estimates the total amount of electricity invoiced to 97,327 clients in metropolitan Beira at 110,160 MWh, for an annual average household usage of 1.132 MWh. On a monthly basis, this equates 94.3 kWh per household. Finally, we estimate the average tariff at about MZN 3.25 per kWh[86]. This equates to an average monthly electricity bill of MZN 306.6 per grid-connected household.

the domestic and commercial sectors, the proportion of nationally distributed power consumed by the city of Beira will increase considerably, to the extent that energy production capacity and/or energy imports will have to increase.

2.3.1 Improving the Conditions for the Existing Population

The following survey data provides estimates for the prevalence of different sources of energy used for household purposes in Beira.

Based on the 2017 city population estimate of 610,000 inhabitants, we estimate that currently roughly 229,970 people have access to quality energy sources, leaving 62.3 percent of households, or roughly 380,030 people without access to quality energy sources. Based on the proportions derived from the family budget survey we estimate the current demand gap for quality energy sources in Beira at 71,645 households. Based on data from previous development efforts undertaken by EDM, the national utility provider, we estimate the cost of a grid connection to be USD 800 on average.[89] We further estimate the cost of a small personal (gasoline-powered) generator at USD 350 and the cost of a residential propane- or natural gas- powered electricity generator at USD 2000. Based on these per-unit costs, we estimate the following:

It should be noted that these costs are merely to provide each household with a means

Table 2.16 Energy Conditions[87]

ENERGY TYPE	HOUSEHOLDS	PROPORTION
Electricity	35,462	37.4
Generator/solar plate	188	0.2
Gas	64	0.1
GOOD QUALITY CONDITIONS	35,714	37.7
Oil / Paraffin / Kerosene	55,485	58.5
Sailing	2,919	3.1
Battery	92	0.1
Firewood	396	0.4
Other	198	0.2
POOR QUALITY CONDITIONS	59090	62.3

Table 2.17 Cost estimates for meeting the current electricity demand gap in Beira

2017 Households without access to quality power sources	2017 est. proportion of households without access to quality power sources	Total Cost (USD) of provision, Electricity grid connection	Total Cost (USD) of provision, Gasoline-powered generator	Total Cost (USD) of provision, Natural gas/Propane residential generator
71,645	62.3	57,316,000	25,075,750	143,290,000

Table Notes: Cost of an electricity grid connection is estimated to be USD 800 per household; the cost of a gasoline generator is estimated to be USD 350 per unit; and the cost of a natural gas or propane generator is estimated to be USD 2,000 per unit

of quality energy consumption, and do not address the cost of electricity provision, natural gas or gasoline.

2.3.2 Accommodating the Future Growth

The following section estimates the infrastructure investments necessary to provide every household with Beira with access to a quality energy source for each of the low-, medium-, and high-growth scenarios. Because the current demand gap was evaluated in the previous section, this section will deal exclusively with future demand (i.e. additional households beyond the estimated 115,000 that currently exist in Beira).

Additionally, it is appropriate to evaluate the provision capacity of the national utility in light of such large proposed increases in service coverage. The following table estimates the increase in tariff revenues from expansion of the electricity grid according to the three scenarios in Table 2.18, as well as the estimated requisite expansion in power production that would be necessary under each scenario.

With regards to methodology, the estimation of future usage and tariff revenues is difficult due to the fact that current average consumption statistics are likely derived from the usage habits of wealthier households. In order to estimate future average usage, we assert that based on

Table 2.18 Financing needs for future demand for electricity in Beira

2035 Population Estimate	Future Number of Households	Estimated New Households	Total Cost (USD), Electric Grid Connection (USD 800/unit)	Total Cost (USD), Gasoline-Powered Generator (USD 350/unit)	Total Cost (USD), Natural Gas/Propane Generator (USD 2000/unit)
Lower Bound: 827,000	156,038	41,038	32,830,188	14,363,207	82,075,472
Middle Range: 1,000,000	188,679	73,679	58,943,396	25,787,735	147,358,491
Upper Bound: 1,422,000	268,302	153,302	122,641,509	53,655,660	306,603,774

*Table Notes: Household size is estimated at 5.3 persons on average. Cost of an electricity grid connection is estimated to be USD 800 per household; the cost of a gasoline generator is estimated to be USD 350 per unit; and the cost of a natural gas or propane generator is estimated to be USD 2,000 per unit

Table 2.19 Projected Tariff Revenues and Power Production Requirements for the City of Beira

Projection	Population	Grid-Connected Households	Total Domestic Consumption, Annual (MWh)	Total Estimated Revenue, Residential Clients (MZN)	Est. Residential Consumption in Beira as % of annual Nat'l Electricity Distribution
2017 Current Population, Est. Actual Provision	610,000	35,462	40,143	130,464,698	1%
2017 Current Population, Target Provision	610,000	115,000	104,190	338,617,500	3%
2035 Lower Bound Growth Estimate	827,000	156,038	141,370	459,453,113	4%
2035 Middle Growth Estimate	1,000,000	188,679	170,943	555,566,038	5%
2035 Upper Bound Growth Estimate	1,422,000	268,302	243,082	790,014,906	7%

Table Notes: Household size is estimated to be 5.3 persons on average. Residential electricity consumption is estimated to be .906 MWh per client. Average estimated electricity tariff is estimated at MZN 3.25 per kilowatt hour. In 2012, total electricity distributed nationally amounted to 3,336 GWh.[90]

Table 2.20 Summary of Cost Estimates, Expansion of Electricity Grid

Details	Cost Range Estimate
Cost estimate for meeting the current demand gap for electricity via expansion of the power grid at an average cost of USD 800 per connection. Total demand in Beira is approximately 115,000 households.	Cost: USD 57.32 million; 71,645 new connections
Cost estimate for meeting demand derived from the lower-bound 2035 population estimate (827,000 residents). This population estimate represents an addition of 41,038 new households relative to 2017.	Cost: USD 32.8 million; 41,038 new connections
Cost estimate for meeting demand derived from the mid-range 2035 population estimate (1,000,000 residents). This population estimate represents 73,679 new households relative to 2017.	Cost: USD 58.9 million; 73,679 new connections
Cost estimate for meeting demand derived from the upper-bound 2035 population estimate (1,422,000 residents). This population estimate represents 153,302 new households relative to 2017.	Cost: USD 122.6 million; 153,302 new connections

our affordability data, the current consumption average of 1.132 MWh per household would likely be maintained across quintiles 3,4 and 5. However, we estimate that households in quintiles 1 and 2 would likely consume only half as much electricity on average. From this, we derive a projected future average annual electricity consumption figure of 0.906 MWh/client.

It is apparent that as service coverage grows in Beira, the national utility will be forced to explore new avenues for providing energy, either via increased imports from the region or by expanding local production capacity. Should demand remain steady and service increase according to the scenarios represented in Table 2.19, Beira's electricity consumption might potentially increase to 7% percent of the amount currently distributed nationally.

A summary of the estimated costs associated with expanding the electricity grid to meet current and future demand gaps in power provision is provided below in Table 2.20

2.4 Financing Needs for Water

Water sector management is nuanced and has multiple sub-sectors: (i) Water Supply, (ii) Sanitation, and (iii) Flood Management. Water supply deals specifically with the availability of clean drinking water sources. Sanitation refers to the municipal institutions and infrastructure responsible for managing the city's wastewater treatment and disposal. Flood management refers to the city infrastructure mitigating the flood effects of substantial or extreme weather events.

The water sector is operations and maintenance intensive and has high recurring costs. [91] This makes maintaining efficiency of service provision difficult, especially with limited financial resources; this is of concern in this sector both nationally, and in Beira. Despite these considerations, we identify the water sector later in the report as an area of primary focus for development due to its central role in maintaining public health. There are several issues with Beira's municipal water and sanitation infrastructure, which are summarized in this section.

2.4.1 Financing Needs for Water Supply

In Beira, the government entity responsible for the provision of drinking water is FIPAG AO Beira (Water Assets and Investment Fund, Beira Area of Operations) which is subordinate to the National Water Directorate (DNA) of the

Figure 2.3 Beira drinking water network[92]

national Ministry of Public Works and Housing. Water tariffs and regulations are determined by the Water Supply Regulatory Council (CRA). Access to quality water sources is defined by access to sanitary municipal water sources. This includes water taps that end both inside and outside the home. By policy, the local government is discouraging the further development of public taps as primary household water sources;[93] consequently, for the purposes of this analysis we will not consider public fountains as quality water sources

Water Supply Service Affordability

Affordability is defined by international standard as expenditure not exceeding more than 5 percent of household monthly budget for both water and sanitation.[94] The data in the top row ("Monthly Total, MZN") of table 2.20 is derived from the quintile average per-capita monthly expenditure figures taken from the cited family budget survey produced by the Istituto Nacional de Estatística (INE)[95], multiplied by an average household size of 5.3 persons.[96]

Table 2.21 Drinking Water Affordability

Household Expenditure (2014-2015)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Monthly Total (MZN)	2,263.00	3,938.00	5,925.00	9,413.00	29,214.00
Water, Est. Actual (% of Monthly Expenditure)[97]	4.34%	4.34%	4.60%	5.56%	7.52%
Water, Est. Actual Monthly Expenditure, Current MZN	98.22	170.90	272.57	523.35	2,196.86
Avg. Monthly Water bill, % of Monthly Expenditure[98]	13%	8%	5%	3%	1%

*Table Notes: The Family Budget Survey data estimates monthly household expenditure by quintile on a mixture of housing- and utility-related items as a percent of the average monthly household expenditure in that quintile (see Table 2.2). We estimate that of the expenditure in this category, 20% is spent specifically on water. Per Doornewaard (2015), the average monthly water bill is estimated at MZN 300.

Table 2.22 Water Supply[100]

TYPOLOGY	HOUSEHOLDS	PROPORTION
Mains water inside the house (network)	11,088	11.7
Mains water outside the home (network)	39,448	41.6
GOOD QUALITY CONDITIONS	50,536	53.3
Public Drinking Fountain	22,896	24.2
Pit / Hole protected	4,040	4.3
Pit without pump (open sky)	15,960	16.8
Rio / Lake / Lagoon	401	0.4
Rain water	5	0
Mineral Water	61	0.1
Other	905	1
POOR QUALITY CONDITIONS	44,268	46.7

Based on average usage statistics, Doornewaard (2015) estimates the average cost per month for a household connected to the water grid to be MZN 300. For a household earning median income (estimated at about MZN 5,000 per month) this accounts for 6 percent on monthly gross earnings. For a poor family, defined in the report as making 60 percent of median household income (roughly MZN 3,000 per month per household) the proportion is around 10 percent. As has been noted previously in this report, many poor families earn substantially less than even this, and with respect to monthly earnings of MZN 2,000 per month per household, this expenditure amounts to 15 percent of the monthly budget. Given the above data, it is likely that affordability of updated water utility services would only be a significant concern for the first and second quintiles.

2.4.1.1 Improving the Conditions for the Existing Population

The following data regarding the typology and prevalence of household water sources is from a INE report on 2008 data gathered in Beira. The number of households estimated in the report is 94,804; estimating an average household size of 5.3 persons[99], this gives a 2008 population estimate of 502,000. Recently, AO Beira managed to add roughly 5,000 household network connections per year.[101] However, this pace is still substantially slower than would be ideal; it would take more than a decade to meet the current demand gap at that rate. The "Future Availability of Drinking Water in Beira" study estimates that a new drinking water connection costs MZN 2,000 per household on average.[102] For the purposes of analysis, we will round this to USD 70 per internal home connection and estimate USD 50 per external home connection. We estimate the current demand gap based on a 2017 population estimate of 610,000 residents (see section 1.3.1 "Current Inhabitants") or alternatively, 115,000 total households (based on an estimated average of 5.3 persons/household) and applying to it the proportion of unconnected households in Table 2.22 on the assumption that it has not substantially changed. This gives the following estimate of the demand gap, and an estimate of the financing necessary to meet it.

Table 2.23 Financing Need for the Current Drinking Water Demand Gap in Beira

2017 Total Households Without Access to Quality Water	Total Cost (USD): Outside-Home Network Connection	Total Cost (USD): In-Home
53,705 or (46.7%)	3,222,300.00	3,759,350.00

*Table Notes: The cost of an outdoor water grid connection is estimated at USD 60 per home; the cost of an indoor water grid connection is estimated at USD 70 per home.

The current demand gap is likely to be even larger than represented above. This report notes that the quality of the existing network is such that bacterial contamination of drinking water is a serious issue, and many residents of the city choose to drink bottled water instead of the water provided by FIPAG AO Beira despite being connected to the municipal network.[103] It is not clear what impact this might have both on household expenditure on drinking water, and on cost recovery for the public utility.

Additionally, the ability of the utility provider to distribute drinking water infrastructure is likely substantially less than represented. In 2015, FIPAG AO Beira estimated water distribution through its network at 14.9 million m3 per year.[104] The "Future Availability of Drinking Water in Beira" study estimates average monthly household usage for grid-connected households at 11.85 m3 per month, which for the 56,000 local grid connections cited in the budget report amounts to 7,963,200 m3 per year.[105] Alternatively, this equates to 0.0735 m3 per capita per day, on average. Since the "Beira Urban Water Master Plan 2035" estimates that domestic water usage accounts for 84 percent of the water invoiced annually, we estimate the total amount of water distributed from its point of origin at the treatment works amounts 9,480,000 m3 per year. Given FIPAG AO Beira's estimates of its distribution capacity, the apparent disparity would equate to 36.4 percent of distribution as non-revenue water due to leakage.

The current estimated length of Beira's drinking water distribution network is 580 km.[106] Of this existing network, Vitens Evides International (VEI) partnered with Municipal Council of Beria (CMB) to rehabilitate 23 kilometers of pipe (in addition to undertaking other repairs, and improvements).[107] The value of this service contract was EUR 6.5 million, and it is unclear what proportion of damaged network this represents. The contract with VEI also included efforts to fix and replace faulty meters and to improve the rate of tariff collection from municipal water customers. CRA's retrospective report to the government covering the period from 2009-2014 notes that FIPAG AO Beira has successfully invoiced based on meter readings at a rate exceeding 95 percent.[108] However, at the time of this report (2015), the commercial director of FIPAG AO Beira estimated that 25-30 percent of customers failed to pay their water bills.[109]

The partnership with VEI has brought to light several structural issues with Beira's water grid that precipitate problems for service reliability, urban expansion and development, and public health. Consultants from VEI have noted that the city does not possess an accurate or detailed map of its pipeline network (indicating both depth and location), or accurate information regarding the size or material composition of the pipes themselves.[110] Pipes are often damaged during the course of construction in the city, and it is difficult for FIPAG AO Beira to identify the location of leaks generally. These issues likely compound FIPAG AO Beira's non-revenue water problem, and negatively impact financial sustainability.

2.4.1.2 Accommodating the Future Growth

Based on the previously cited low (2.25%), medium (3.25%), and high (4.25%) population growth projections extrapolated from the

Table 2.23 Financing Need for Future Drinking Water Demand in Beiraty

Growth Rate Projection	2035 Population Estimates	Estimated Future Number of Households	Estimated New Households	Total Cost (USD): Outside-Home Network Connection	Total Cost (USD): In-Home Network Connection
2.25%	827,000	156,038	41,038	2,462,264	2,872,642
3.25%	1,000,000	188,679	73,679	4,420,755	5,157,547
4.25%	1,422,000	268,302	153,302	9,198,113	10,731,132

*Table Notes: Household size is estimated to be 5.3 persons on average. Beira's 2017 population estimate indicates about 115,000 households. The cost of an outdoor water grid connection is estimated at USD 60 per home; the cost of an indoor water grid connection is estimated at USD 70 per home.

2007 census (population estimate 443,369), the following is estimated with respect to the future demand gap:
It is also important to recognize that the cost of expanding the pipeline network is only a portion of the cost associated with meeting demand for water. The expansion of service also necessitates an expansion of existing production and maintenance capacity such that quality and duration of service are not negatively impacted.[111] It tends to be the case that water provision, measured in availability hours, drops in areas that see expansion in their grids that is unaccompanied by investment to improve upon the capacity of their intake and treatment infrastructure.[112] It is difficult to estimate these costs without information on the cost of construction for an expansion of the treatment work. However, the following figures contain estimates for the expanded intake and production capacity that would be needed to meet both the current demand gap and future demand scenarios, as well as estimates of future revenue and operating costs derived from the expansion of utility provision. The production capacity estimates are represented as a necessary percent increase over the current provision capacity.

With regards to methodology, the estimation of future usage and tariff revenues is difficult due to the fact that current average consumption statistics are likely derived from the usage habits of wealthier households. In order to estimate future average usage, we assert that based on our affordability data, the current water consumption average of MZN 300 per household would likely be maintained across quintiles 3,4 and 5. However, we estimate that households in quintiles 1 and 2 would likely consume only half as much municipal water on average. From this, we derive a projected future average annual water consumption figure of MZN 240/client. In addition to the revenues collected for water distribution, FIPAG AO Beira is responsible for collecting 15 percent surcharge on water consumption meant to finance the municipal sanitation agency SASB. FIPAG AO Beira retains 2.5 percent of the surcharge and transfers 12.5 percent to the municipality.[113] It is important to note however, that at present, we estimate that this surcharge is only applied to Beira's sewered central district, which we estimate to consist of only 11,200 to 19,900 households (see the following section on sanitation). This, at present, would account for additional revenues of MZN 1 million to MZN 1.79 million per year, or less than 1 percent of total revenues.

Finally, with respect to volume of consumption, we would expect to revise down the future estimated average usage to 113.76 m3 per household. With regards to operating costs, in 2015, FIPAG AO Beira indicated operating costs of MZN 231.4 million to service roughly 56,000 customers; therefore, we propose a rough expenditure estimate of MZN 4,132 annually per network-connected household.
There are several important observations

with regards to the above estimates. The first is that FIPAG AO Beira recorded actual revenues in 2015 that were 35 percent greater than what we would expect given the tariff implied by the consumption statistics (average expenditure = MZN 300 per household per month; average consumption = 11.85 m3 per household per month) cited by Doornewaard (2015).[114,115] This difference in revenue estimates may be due to non-itemized services, or fiscal transfers, or it may be because we have underestimated the tariff in our analysis. Should the tariff be greater than in our estimation, revenues would have to be revised, as would considerations of affordability.

Second, and notably, even meeting the current demand gap would require the current intake and treatment capacities of FIPAG AO Beira to increase to 160 percent of their current size. High-range population growth estimates would require it to

Table 2.24 Estimated Tariff Revenues from Water Provision, FIPAG AO Beira

Population Estimate 2035	Estimated number households (Total)	Estimated Number of Water Connections Needed for Total Coverage	Annual Revenue from water tariffs (MZN)	Net Annual Revenues (water tariffs plus 2.5% of sanitation surcharge) (MZN)	Estimated Annual Expenditure on Service Provision (MZN)	Estimated Net Revenues, % of estimated expenditure
2017 Current Coverage Gap	115,000	60,998	331,200,000	339,480,00	475,180,000	71.4%
Low Bound Estimate: 827,000	156,038	41,038	449,388,679	460,623,396	644,749,016	71.4%
Medium Estimate: 1,000,000	188,679	73,679	543,396,226	556,981,132	779,621,628	71.4%
High Bound Estimate: 1,422,000	268,302	153,302	772,709,434	792,027,170	1,108,623,864	71.4%

The figure highlighted in red for average annual revenue for 2017 represents a 7 percent increase over the 2015 revenue figure for FIPAG AO Beira contained in section 1.6.3.4. For the purposes of estimating net annual revenues at present, we assume the sanitation surcharge is levied on 19,900 households. If coverage is extended to all households in Beira, we estimate that the average monthly water bill will be MZN 240 per household. For the purposes of estimating future net revenues, we assume the sanitation surcharge is applied to all water bills. The estimated annual cost of service provision is MZN 4,132 per household.

Table 2.25 Estimated Tariff Revenues from Water Provision, FIPAG AO Beira

Population Estimate	Estimated annual Demand for Water, All Customers	Total Distribution Capacity required (m3)	Necessary expansion of distribution capacity	Total Intake Capacity Required) (m3)	Necessary Expansion of Intake Capacity, % of Current	Estimated Net Revenues, % of estimated expenditure
2017 Current Coverage Gap	15,574,286	24,487,871	164%	29,397,204	160%	71.4%
2035 Low Bound Estimate: 827,000	21,132,003	33,226,420	223%	39,887,659	217%	71.4%
2035 Medium Estimate: 1,000,000	25,552,527	40,176,929	270%	48,231,607	262%	71.4%
2035 High Bound Estimate: 1,422,000	36,335,757	57,131,693	383%	68,585,466	373%	71.4%

It is important to note that estimated annual demand for all customers includes both commercial and residential customers; these estimates assume that the proportion of demand from each group remains fixed (i.e residential customers account for 84% of total demand).These figures assume the following: the current volume of water successfully delivered to all customers is 9.141 million cubic meters annually; the estimated volume of distributed water that is lost to grid leakage before being delivered is 36.4% of water distributed by the service provider; the current distribution capacity of the system is 14.9 million cubic meters; the amount of water distributed is 83.3% of water intake; and the current intake capacity of the system is 18.39 million cubic meters.

increase to over 350 percent of the current size to achieve full service coverage.

It should be noted that part of the current Vitens Evides International public private partnership involves increasing the distribution capacity of the utility by 10 percent;[116] it is not clear that this is adequate to fully close the demand gap, though it may substantially improve coverage if undertaken in concert with efforts to pursue a significant reduction in non-revenue water due to leakage. Based on our analysis, we estimate that the financing required to provide network connections to currently unconnected households at USD 3.8 million. Furthermore, the cost of fully meeting the current demand gap would include the additional cost of expanding the intake and distribution works to 160 percent of their current capacity. Based on our urban growth estimates, we estimate the cost range of providing network connections to new households between USD 2.9 million (low growth estimate) to USD 10.7 million (high growth estimate). Furthermore, the cost of fully meeting the current demand gap would include the additional cost of expanding the intake and distribution works to between 217 percent and 373 percent of their current capacity, respectively. A summary of the estimated costs associated with expanding grid water provision to meet current and future demand gaps in drinking water provision is provided below in Table 2.26

Table 2.26 Summary of Cost Estimates, Expansion of Beira's Water Grid

Details	Cost Range Estimate
Cost estimate for meeting the current demand gap via expansion of the water grid at an average cost of USD 70/connection. Total demand in Beira is approximately 115,000 households.	Cost: USD 3.8 million; 60,998 new connections
Cost estimate for meeting demand derived from the lower-bound 2035 population estimate (827,000 residents). This is 41,038 new households beyond the current 115,000.	Cost: USD 2.9 million; 41,038 new connections
Cost estimate for meeting demand derived from the mid-range 2035 population estimate (1,000,000 residents). This is 73,679 new households beyond the current 115,000.	Cost: USD 5.2 million; 73,679 new connections
Cost estimate for meeting demand derived from the upper-bound 2035 population estimate (1,422,000 residents). This is 153,302 new households beyond the current 115,000.	Cost: USD 10.7 million; 153,302 new connections
Estimated necessary increase in production capacity to meet the current demand gap. Total demand in Beira is approximately 115,000 households.	Requisite level of intake/treatment capacity: 160% of current
Estimated necessary increase in production capacity to meet the lower-bound 2035 population estimate (827,000 residents).	Requisite level of intake/treatment capacity: 217% of current
Estimated necessary increase in production capacity to meet the mid-range 2035 population estimate (1,000,000 residents).	Requisite level of intake/treatment capacity: 262% of current
Estimated necessary increase in production capacity to meet the upper-bound 2035 population estimate (1,422,000 residents).	Requisite level of intake/treatment capacity: 373% of current

Table 2.27 Sanitation Service Affordability

Household Expenditure 2014-2015	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Monthly Total (MZN)	2,263.00	3,938.00	5,925.00	9,413.00	29,214.00
Monthly water expenditure by quintile, estimated % of monthly total expenditure)[118]	4.34%	4.34%	4.60%	5.56%	7.52%
Monthly sanitation expenditure by quintile, as a % of quintile avg. monthly total expenditure	1%	1%	1%	1%	1%
Total expenditure on water and sanitation tariffs, as a % of quintile average monthly total expenditure	5.34%	5.34%	5.60%	6.56%	8.52%
Avg. Monthly Water Grid bill, % of quintile monthly expenditure	13%	8%	5%	3%	1%
15% sanitation tariff levied on avg. monthly grid water bill, as a % of quintile monthly expenditure	2%	1%	1%	**N/A	**N/A
Total expenditure, water and sanitation tariffs, based on average water grid bill, as a % of quintile monthly expenditure	15%	9%	6%	**N/A	**N/A

*Table Notes: The family budget survey data estimates monthly household expenditure by quintile on a mixture of housing- and utility-related items. We estimate that of the expenditure in this category, 20% is spent specifically on water. The average sanitation expenditure of each quintile is estimated to be 15% of the quintile average expenditure on water (i.e. a 15% tariff on water consumption). The average monthly water bill across all quintiles is estimated to be MZN 300 per household.

**Sections marked "N/A" would represent a decrease in overall water consumption for quintiles 4, 5.

2.4.2 Financing Needs for Sanitation

For the purposes of this analysis, we treat any waste disposal method that does not pose a significant public health risk as adequate. However, in analyzing potential for development, we propose that it should be the case that providing sewer connections or septic systems serviced by the municipal sanitation authority is the ultimate objective of development efforts.

Affordability of Sanitation Services

Affordability is defined by international standards as expenditure not exceeding more than 5% of household monthly budget for both water and sanitation.[117] Municipal waste management services are currently funded by a 15 percent surcharge on water bills, of which 12.5% is transferred to SASB and 2.5% is retained by FIPAG AO Beira.

The table above estimates combined expenditure on water and sanitation given a hypothetical 15 percent sanitation surcharge levied on water bills. It should be reiterated that lower-income households likely are not actually contributing revenues to the municipal sanitation authority, as the poorer areas of Beira are not-sewer connected (and in many cases, not connected to the water grid either). However, the purpose of Table 2.27 is simply to demonstrate the average financial burden, by quintile, of a 15 percent tariff applied to both quintile average water expenditure, and grid-connected household average water expenditure.

lower-income households likely are not actually contributing revenues to the municipal sanitation authority, as the poorer areas of Beira are not-sewer connected (and in many cases, not connected to the water grid either). However, the purpose of Table 2.27 is simply

to demonstrate the average financial burden, by quintile, of a 15 percent tariff applied to both quintile average water expenditure, and grid-connected household average water expenditure. The data in the above table demonstrate the following:

- All else equal, if the municipality implemented a fee-for-service sanitation plan to cover low income households, even the lowest quintiles currently have the capacity to pay some small tariff and still remain reasonably close to the 5 percent affordability benchmark.

- For the bottom two quintiles, the average grid water bill (MZN 300 monthly) plus implied sanitation tariff is not affordable; however, it is a reasonable expense for the top three quintiles.

Because the revenue mechanism for sanitation is tied to municipal water (as wastewater generation is often estimated as a percentage of water consumption), the expansion of municipal sewer services would likely need to be funded by a simultaneous expansion in drinking water provision, or by a newly-created dedicated tariff. Investment in septic systems would have to be accompanied by the establishment of public or private sector options for fee-for-service waste management. It is not clear whether the City of Beira offers municipal sanitation services to households using decentralized sanitation methods in non-sewered areas of the city.[120]

2.4.2.1 Improving the Conditions for the Existing Population

Investment in sanitation infrastructure is an extremely pressing need in Beira. Frequent flooding combined with inadequate sanitation infrastructure and a large proportion of the population that depends upon informal sources of drinking water makes the improper disposal of human waste a significant public health concern.

We can see above in Figure 2.4 that the sewered areas of the city are the relatively more affluent, planned areas of the peninsula that surround the port and central district on the western edge, and the neighborhoods of the southern edge. The central-east and northeast parts of the peninsula remain without municipal services.

Figure 2.4 Beira current sewer network[121]

Table 2.28 Sanitation Conditions[122]

TYPOLOGY	HOUSEHOLDS	PROPORTION
Toilet connected to septic tank	16,359	17.3
Latrine Improved	31,076	32.8
Latrine Traditional Improved	6,444	6.8
GOOD QUALITY CONDITIONS	53,879	56.9
Latrine Traditional Not Improved	12,925	13.6
Without Latrine	28,000	29.5
POOR QUALITY CONDITIONS	40,925	43.1

Table 2.29 Cost Estimates, Updated Sanitation Services for City of Beira

Current Condition	Number of Households	Total Cost (USD) Update to Septic System/Sewer	Total Cost (USD) Update to High Quality Latrine	Total Cost (USD) Update to Improved Latrine
Without Latrine	33,062	27,682,800	16,962,500	10,177,500
Latrine, Unimproved	15,640	12,762,240	7,820,000	4,692,000
Improved Latrine	7,820	6,381,120	1,564,000	-
High Quality Latrine	37,720	30,779,520	-	-
Total Cost		77,605,680	26,346,500	14,869,500

Cost per unit of septic system/sewer connection estimated at USD 816 per household; cost per unit of a high quality latrine is estimated at USD 500; the cost per unit of an improved latrine is estimated at USD 300 per unit.

The cost estimates contained in the table below are derived from the above proportions applied to an existing population of approximately 610,000 residents (115,000 households). Morón (2014) cites a World Bank report that estimated the per-capita cost of a conventional sewer connection at USD 154; assuming an average household size of 5.3 persons, this amounts to USD 816 per household.[123] We scaled downward the cost estimates for the remaining options according to the quality of that option.

The Beira Master Plan 2035 recommends development of condominial sewer connections for unplanned neighborhoods, and updated, safe latrines in peri-urban currently beyond the reach of the city sewer system.[124] Options to meet demand for latrine/septic system management include provision by central government, or a decentralized approach. A decentralized, private-sector approach has been successful in other cities; in Tanzania, private sector competition has reduced fees to USD 3.75 per trip, with same-day service.[125]

It is estimated that 10 trucks can adequately service 12,000 households.[126] Assuming that somewhere between 10,000 and 20,000 households are currently serviced by the municipality, an investment to supply the remaining population with modern sanitation would necessitate the follow-on purchase of a fleet of about 80 trucks in order to meet demand for latrine/septic drainage services. If each of these trucks is USD 150,000, this is an investment of roughly USD 12 million.

Table 2.30 Cost Estimates, Meeting Future Demand for Sanitation Services in Beira

2035 Population Estimate	Number of New Households	Total Cost (USD) Purchase Septic System/Sewer	Total Cost (USD) Purchase High Quality Latrine	Total Cost (USD) Purchase Improved Latrine
Lower Bound Estimate: 827,000	41,038	33,487,000	20,519,000	12,311,400
Medium Growth Estimate: 1,000,000	73,679	60,122,064	36,839,500	22,103,700
Upper Bound Estimate: 1,422,000	153,302	125,094,432	76,651,000	45,990,600

For 2017, there are an estimated 115,000 households in Beira. Cost per unit of septic system/sewer connection estimated at USD 816 per household; cost per unit of a high-quality latrine is estimated at USD 500; the cost per unit of an improved latrine is estimated at USD 300 per unit.

2.4.2.2 Accommodating the Future Growth

The following cost estimates are for future growth in demand beyond the current demand gap estimated in section 2.4.2.1.[127]

While Morón (2014) estimates the cost of 150,000 new sewer connections at USD 104 million, our estimate for a comparable number of new connections (see bottom row of Table 2.30) provides an upper bound estimate of USD 125 million (roughly 25 percent greater) based on the per capita connection price cited in section 2.4.2.1.[127]

As in the case of the power and water utilities, the capacity of the municipal authority to manage large increases in service provision will be a major concern. According to the Beira Urban Water Master Plan 2035, the current intake capacity of Beira's wastewater treatment infrastructure is 7500 m3 per day, which amounts to 2,737,500 m3 year. According to the report, mean daily wastewater intake is 2,450 m3 a day, or 894,280 m3 per year.

Data on wastewater utility provision from 2004 estimated that 59,833 residents of Beira were served by the municipal authority (this equates to roughly 11,200 households). We will use this as a lower-bound estimate for current coverage based on the report's assertion that that a negligible number of sewer connections has been added in the recent past. If we apply the proportion of residents with access to modern sewer or septic systems recorded in the family budget survey (17.3 percent) to the current population of Beira, we derive an upper-bound estimate of 19,900 households that are likely contributing to wastewater inflows managed by the municipality. We stress that service by the municipal waste management utility does not necessarily imply a sewer connection; it simply implies some waste management configuration (such as a sewer connection or septic system) that is serviced by the city. Indeed, a 2012 report on sanitation surcharges estimated that only about 8500 households in Beira's central district had sewer connections. Here we note that SASB budget figures indicate revenues in 2015 amounted to MZN 17.57 million; if the water bill surcharge was the only source of this revenue, this would mean the surcharge was levied on roughly 39,000 households. The fact that this is wildly inconsistent with other estimates mean that SASB is likely funded via general tax revenues in addition to the surcharge.

Noting that each of the above coverage estimates results in a different household rate of wastewater generation (0.2188 m3 per household per day for the lower bound service estimate; 0.1231 m3 per household per day for the upper bound service estimate), we project out the implications for necessary intake capacity based on each population growth scenario.

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If we apply the proportion of residents with access to modern sewer or septic systems recorded in the family budget survey (17.3 percent) to the current population of Beira, we derive an upper-bound estimate of 19,900 households that are likely contributing to wastewater inflows managed by the municipality. We stress that service by the municipal waste management utility does not necessarily imply a sewer connection; it simply implies some waste management configuration (such as a sewer connection or septic system) that is serviced by the city. Indeed, a 2012 report on sanitation surcharges estimated that only about 8500 households in Beira's central district had sewer connections.[129] Here we note

Table 2.31a Lower-Bound Service Estimate for Sanitation in Beira

	Estimated Number of Connected Households	Avg. Daily Waste Intake	Avg. Yearly Waste Intake (m3)	Necessary level of Intake Capacity (% of Current)
Current (lower bound service estimate)	11,200	2,450	894,250	Adequate
Target	115,000	25,156	9,182,031	335%
Low Growth	156,038	34,133	12,458,638	455%
Medium Growth	188,679	41,274	15,064,858	550%
High Growth	268,302	58,691	21,422,229	783%

For the purposes of these estimates, the household wastewater generation rate is assumed to be 0.2188 cubic meters per day. The current intake capacity for the treatment works is 7,500 per day.

Table 2.31b Upper-Bound Service Estimate for Sanitation in Beira

	Estimated Number of Connected Households	Avg. Daily Waste Intake	Avg. Yearly Waste Intake (m3)	Necessary level of Intake Capacity (% of Current)
Current (upper bound service estimate)	19,900	2,450	894,280	Adequate
Target	115,000	14,159	5,167,950	189%
Low Growth	156,038	19,211	7,012,132	256%
Medium Growth	188,679	23,230	8,478,999	310%
High Growth	268,302	33,033	12,057,136	440%

For the purposes of these estimates, the household wastewater generation rate is assumed to be 0.1231 cubic meters per day. The current intake capacity for the treatment works is 7,500 per day.

Table 2.32 Tariff Revenue Estimates for Sanitation Services in Beira

Population Estimate	Number of water grid-connected households (Total)	Avg. Annual Revenue from Domestic Water Customers (Gross)	Est. Annual Revenue for Public Sanitation Services from Domestic sources	Cost of Operation, Based on 2015 SASB Expenditures	Est. Annual Revenue, Proportion of Est. Annual Operating Costs
2015 Coverage	54,000	194,400,000	17,565,374	30,705,728	57.2%
Current Target Coverage	115,000	331,200,000	41,400,000	108,560,000	38.1%
2035 Low Growth Estimate: 827,000	156,038	449,388,679	56,173,585	147,299,872	38.1%
2035 Medium Growth Estimate: 1,000,000	188,679	543,396,226	67,924,528	178,112,976	38.1%
2035 High Growth Estimate: 1,422,000	268,302	772,709,433	96,588,679	253,277,088	38.1%

The figures in red are taken directly from SASB budget documents. If the sanitation tariff of 12.5% of all municipal water bills was levied on all water grid-connected households, this figure would be in the area of MZN 24.3 million. However, it appears based on SASB budget that listed 2015 revenues at MZN 17.5 million, that the sanitation tax is not leveraged on all water utility customers. Should coverage be extended to all households, we estimate that the average household water bill will be MZN 240 per month. To estimate future sanitation revenues, we assume the surcharge will be applied to all water bills. We estimate the cost of service provision to be MZN 944 per household annually.

that SASB budget figures indicate revenues in 2015 amounted to MZN 17.57 million; if the water bill surcharge was the only source of this revenue, this would mean the surcharge was levied on roughly 39,000 households. The fact that this is wildly inconsistent with other estimates mean that SASB is likely funded via general tax revenues in addition to the surcharge.

Noting that each of the above coverage estimates results in a different household rate of wastewater generation (0.2188 m3 per household per day for the lower bound service estimate; 0.1231 m3 per household per day for the upper bound service estimate), we project out the implications for necessary intake capacity based on each population growth scenario.

Each population growth projection will likely necessitate an expansion in the current wastewater intake capacity; even assuming the upper-bound estimate for current service coverage (i.e. the smaller current demand gap, and lower per-household wastewater generation rate), addressing just the current demand gap would require an increase in the capacity of the municipal utility provider to nearly 200 percent its current maximum capability. It should be noted that the current treatment works were constructed with EUR 63 million in EU funding.[130]

As previously stated, revenues for the municipal sanitation authority are a fiscal transfer from the municipal drinking water utility in the amount of 12.5 percent of water revenues. Table 2.32 estimates revenue derived specifically from the expansion of domestic water provision. Operation costs are estimated by increasing expenditures in proportion with population. The “2015 Current Coverage” expenditure is based on actual 2015 SASB expenditure figures listed in section 1.7.3.5. Even with the expansion of domestic water provision some other policy instrument and revenue source would be required to cover the operating cost of the municipal sanitation authority; the figures above indicate a substantial operating deficit for SASB even in an ideal scenario, in which the sanitation tariff is successfully levied on all households.

A summary of the estimated costs associated with expanding sanitation service provision to meet current and future demand gaps in sanitation provision is provided below in Table 2.33

Table 2.33 Summary of Cost Estimates, Expansion of Quality Sanitation Services in Beira

Details	Cost Range Estimate
Cost estimate for meeting the current demand gap via expansion of quality sanitation services. At an average cost of USD 300/latrine, or USD 816/sewer connection. Meeting the current demand gap requires approximately 48,702 upgraded household sanitation systems	Cost: USD 14.9 million to 77.6 million
Cost estimate for meeting demand derived from the lower-bound 2035 population estimate (827,000 residents). This is 41,038 new households.	Cost: USD 12.3 million to 33.5 million
Cost estimate for meeting demand derived from the mid-range 2035 population estimate (1,000,000 residents). This is 73,679 new households.	Cost: USD 22.1 million to 60.1 million
Cost estimate for meeting demand derived from the upper-bound 2035 population estimate (1,422,000 residents). This is 153,302 new households.	Cost: USD 45.9 million to 125.1 million
Estimated necessary increase in wastewater treatment intake capacity to meet the current demand gap, assuming all sanitation demand is met via expansion of septic systems and sewer connections. Based on a daily per-household waste generation rate range of 0.1263 m3 to 0.2188 m3.	Requisite size of treatment/ distribution capacity: 194% to 335% of current level
Estimated necessary increase in wastewater treatment intake capacity to meet demand according to the lower-bound 2035 population estimate (827,000 residents, or 41,038 new households). Assumes all sanitation demand is met via expansion of septic systems and sewer connections. Based on a daily per-household waste generation rate range of 0.1263 m3 to 0.2188 m3.	Requisite size of treatment/ distribution capacity: 263% to 455% of current level
Estimated necessary increase in wastewater treatment intake capacity to meet demand according to the middle range 2035 population estimate (1,000,000 residents, or 73,679 new households). Assumes all sanitation demand is met via expansion of septic systems and sewer connections. Based on a daily per-household waste generation rate range of 0.1263 m3 to 0.2188 m3.	Requisite size of treatment/ distribution capacity: 318% to 550% of current level
Estimated necessary increase in wastewater treatment intake capacity to meet demand according to the lower-bound 2035 population estimate (1,422,000 residents, or 153,302 new households). Assumes all sanitation demand is met via expansion of septic systems and sewer connections. Based on a daily per-household waste generation rate range of 0.1263 m3 to 0.2188 m3.	Requisite size of treatment/ distribution capacity: 452% to 783% of current level

2.4.3 Financing Needs for Solid Waste

The municipal authority responsible for solid waste management is the Department for the Environment and Management of Solid Waste (DAGRS).[131] It is unclear whether the department's budget is managed independently of the municipal budget (i.e. funded via general tax revenues, or by a dedicated tariff). Without any way of determining the average per-household cost of these services, it is not possible to analyze the financial burden on customers (i.e. affordability). However, the 2015 CMB budget report lists as an expenditure category "Collect, deposit and treatment of waste" with an associated expenditure of MZN 34,425,000. [132] Assuming a period average exchange rate for 2015 of 40 MZN/USD, these equates to roughly USD 860,625. As this figure does not match SASB's 2015 expenditure (though it is only about 13 percent greater), we suspect that this item refers to expenditure specifically on solid waste management. We will estimate future costs based on this assumption.

The current capability of the city is provided by a fleet of 7 compactor trucks and 7 container trucks, and a dedicated workforce that we estimate at around 200 employees (30-35 drivers by the report estimate, plus a greater number of collection operation support staff).[133]

In Maputo, municipal solid waste management services are financed via a tariff on electricity consumption.[134] In this way, Maputo is able to take advantage of an existing collections infrastructure that in 2011 already covered greater than 90 percent of households in the city. The City of Maputo also charges service premiums on excessive and non-residential waste producers, and maintains a license registry for patrons of these services.[135] The city additionally charges fees at disposal sites, and levies fines on illegal dumping.[136] In the event that Beira looks to this model for financing waste management, it should be noted that in Maputo in 2012, these economic instruments only covered 69 percent of operating costs. [137] Therefore, efforts to increase revenues and to recycle and bring waste generation rates to sustainable levels remain of central importance.

2.4.3.1 Improving the Conditions for the Existing Population

The Family Budget Survey does not list household expenditure data on solid waste management services.

The Ministry for the Coordination of Environmental Action (MICOA) estimates solid waste production in Beira at approximately 162,000 tons per year, or 444 tons per day.[138] This amounts to a per capita waste generation rate of 0.27 tons per year assuming a city population of roughly 610,000. Tas and Belon (2014) estimate that the city of Beira manages to collect about 75 percent of the city's solid waste.[139] It is disposed of via landfill.

To increase coverage so that the city would be able to manage the remaining uncollected 25 percent of solid waste, we estimate that the city should increase its current capacity (workforce, trucks, etc.) by 33 percent. In terms of fixed capital asset investment, this would involve the purchase of at least four more trucks, two of each type, at an estimated cost of USD 600,000 USD (USD 150,000 per unit). A 25 percentage-point increase in the annual expenditure on solid waste management would result in annual expenditure of USD 1.1 million (an increase over current expenditure levels of USD 240,000).

It should be noted however that Tas and Belon (2014) cite a daily waste generation rate in urban areas of 1kg per person, based on official figures for Maputo and Matola.[140] This relatively higher annual solid waste generation rate of 0.4 tons per person would require that all the estimated figures in Sections 2.4.3.1 & 2.4.3.2 to be revised upward by 50 percent.

As an alternative, high-bound estimate of the current financing gap, we can use Maputo's nearly USD 6 million annual expenditure on waste management as a point of comparison.[141] If waste management needs are proportional to population, and Beira is roughly 35 percent the size of Maputo, then Beira's true financial need for waste management operations (excluding

Table 2.34 Future Financing Need for Solid Waste Management Services in Beira

2035 Population Estimate	Estimated total number of Households	Estimated Annual Total, Solid Waste Generation (Tons)	Necessary Service Provision (% of current capacity)	Estimated Total Annual Cost of Service Provision (USD)	Necessary Additional Fixed Capital Investment, i.e. trucks and related equipment (USD)
Low Growth Estimate: 827,000	156,038	223,290	183%	2,928,000	1,800,000
Medium Growth Estimate: 1,000,000	188,679	270,000	222%	3,552,000	2,550,000
High Growth Estimate: 1,422,000	268,302	383,940	316%	5,056,000	4,500,000

Current number of households in Beira (as of 2017) estimated at 115,000. Solid waste generation rate is estimated at 0.27 tons per person per year. The current capacity of the municipal solid waste service is 121,500 tons per year. The cost of meeting current demand for solid waste management is estimated at USD 1.6 million per year.

Table 2.35 Estimated Tariff Revenues for Solid Waste Management in Beira

Population Estimate	Electricity Utility Coverage Targets (Number of Households)	Estimated Annual Revenues from Electricity (USD)	Avg. Annual Revenue from Domestic Sources for Solid Waste Management (10% tariff on electricity consumption)	Estimated Total Annual Cost of Service Provision (USD)
2017 Current Coverage	35,462	3,261,617	326,162	20%
2017 Target Coverage	115,000	8,280,000	828,000	52%
2035 Low Growth Estimate: 827,000	156,038	11,234,736	1,123,474	71%
2035 Medium growth Estimate: 1,000,000	188,679	13,584,888	1,358,489	71%
2035 High Growth Estimate: 1,422,000	268,302	19,317,744	1,931,774	71%

Figures converted to USD using 2015 period average exchange rate of 40 MZN/USD. Should electricity grid coverage be extended to the whole city, we estimate that the average electricity bill will be roughly MZN 240 per month.

fixed capital investment) may be as high as USD 2.1 million annually. Moving forward, we will assume the current total operations and maintenance financing need is between these two estimates, at USD 1.6 million per year.

2.4.3.2 Accommodating the Future Growth

Cost estimates are for future growth in demand beyond the current demand gap are given below:

It is not clear if there are any specific policy instruments designated for generating revenue for solid waste management, or if the service is funded via general tax revenues. In Maputo however, the municipal solid waste management utility is at least partially funded by a tariff on electricity consumption. The figure below estimates revenues for solid waste management should the City of Beira implement a tariff of 10 percent on electricity bills (similar to the 15 percent tariff on water consumption for wastewater management). Such a tariff would have the benefit of being progressive, as it would generate most of its

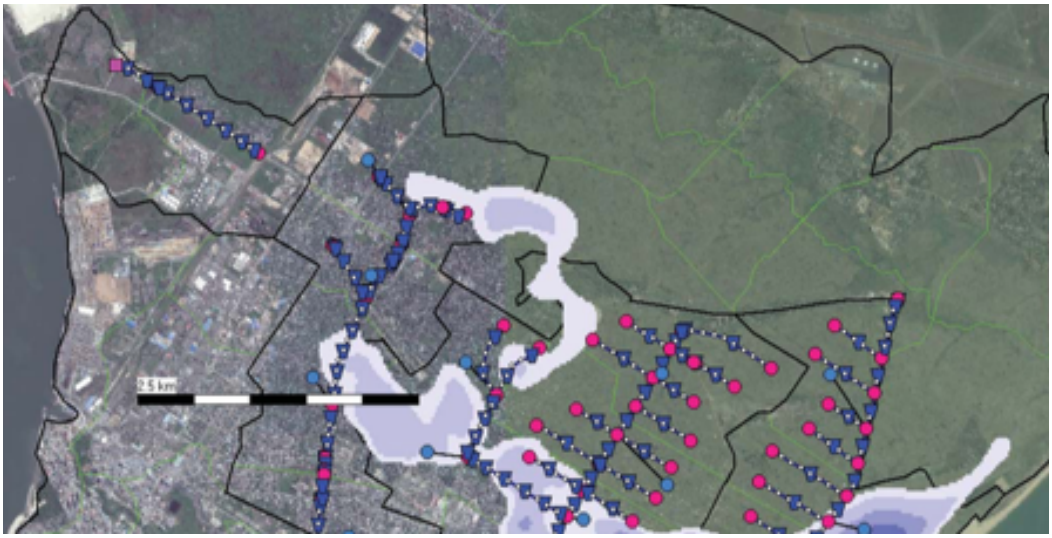
revenue from wealthier households that use more electricity. At present, a 10 percent on electricity consumption would only cover about 20% of our current estimated expenditure on solid waste management. If both electricity service coverage and solid waste management coverage were expanded to cover the entire city, and a 10 percent tariff on electricity consumption were implemented, only about 52 percent of the operating cost of the solid waste management authority would be covered.

Although Beira manages to collect a large proportion of the solid waste generated in the city, there are substantial negative spillover effects from uncollected solid waste that have severe consequences for Beira's poorest residents. The most serious issues result from

Table 2.36 Summary of Cost Estimates, Expansion of Solid Waste Management Services in Beira

Details	Cost Range Estimate
Cost estimate for meeting the current demand gap via expansion of the solid waste management services by 33% (current estimated coverage is 75%). Total demand in Beira is approximately 115,000 households.	Investment in new equipment: USD 0.6 million
Cost estimate for meeting demand derived from the lower-bound 2035 population estimate (827,000 residents). This is 41,038 new households. O&M costs based on proportional adjustment of estimated current annual O&M need of USD 1.6 million.	Investment in new equipment: USD 1.8 million O&M: USD 2.9 million per year (Total, including current)
Cost estimate for meeting demand derived from the mid-range 2035 population estimate (1,000,000 residents). This is 73,679 new households.	O&M: USD 2.9 million per year (Total, including current)
Cost estimate for meeting demand derived from the upper-bound 2035 population estimate (1,422,000 residents). This is 153,302 new households.	Investment in new equipment: USD 4.5 million O&M: USD 5.1 million per year (Total, including current)

Figure 2.4 Beira current sewer network[144]



burned or buried garbage, as well as flooding resultant from clogged drainage ditches.

A summary of the estimated costs associated with expanding solid waste management services to meet current and future demand gaps in waste management is provided below in Table 2.36.

2.4.4 Financing Needs for Flood Management

Mozambique has 2700 km of coastline on the Indian Ocean and experiences major weather events on a regular basis. The threat of these weather events to the country is compounded by high rates of growth and urbanization in Mozambique's coastal cities. The country has experienced at least 6 major floods in the past 45 years.[142] In the period spanning 1956-2008, 15 cyclones made landfall in Mozambique. In the same period, droughts have affected over 16 million people.

The last major weather event to affect Beira, a cyclone, was in 2000 and it displaced 20,000 people and caused USD 60 million worth of asset damage.[143] Flooding and associated damage to housing, water, and sanitation infrastructure also result in significant public health hazards, with Malaria and Cholera being the two most common. The frequency with which Beira experiences extreme weather events that cause a significant sea level rise of 1m is currently once every ten years, a rate that is expected to quadruple in frequency in the future.[145]

The division of responsibility between national and municipal government entities for the management of flood mitigation infrastructure is unclear. There are many stakeholders, including the municipal government; SASB, which is the municipal department responsible for sanitation and drainage infrastructure; the city airport; Mozambique Ports and Railways; businesses and property owners adjacent to the coast; and national government entities responsible for environmental affairs (MICOA) and disaster management (INGC).

2.4.4.1 Improving the Conditions for the Existing Population

The cited INGC report estimates that Beira's minimum necessary infrastructure investment is USD 27 million, mostly for the purpose of coastal defense, though true need is likely roughly ten times greater (i.e. USD 270 million). The maximum cost estimate for full investment in mitigation of coastal vulnerability is USD 357.9 million.[146]

Currently, expected economic loss due to climate change related causes is estimated at USD 20 million by 2030, though the 2012 INGC Report estimates that this loss is likely to increase by between 475 to 925 percent. It additionally notes that this figure cannot account the damage risk of an extreme outlier event.

We estimate Beira's economic vulnerability to be significantly higher than even the high-end estimate for mitigation. The INGC report values Beira's total fixed capital asset stock in 2010 at USD 2.9 billion, with its current risk exposure due to climate change related events being roughly 20 percent.[147] This would place the current economic value of Beira's exposed fixed capital asset stock at around USD 580 million. Though expected loss estimates are much lower, it is important to keep this exposure in mind, as an unexpected extreme event, or a series of unexpected extreme events could cause significant destruction.

Additionally, the report projects total fixed capital asset value to increase to roughly USD 13.6 billion by 2030.[148] As the city grows both more densely populated and developed over time, the risk exposure as a percentage of fixed capital asset value is likely to increase over time. The INGC report further estimates that 39 percent of expected loss will not be covered by adaptation measures, and therefore recommends the exploration of risk transfer mechanisms.[149]

In Beira, a large population currently resides within the flood/storm hazard zones. We estimate the size of this hazard area to be about 40 percent of the city's administrative area, or about 252.4 km2. If the population density across the entire administrative area is 967 persons/km2, then we estimate that 244,071 inhabitants or 46,051 households, or

roughly 40 percent of the population of the city resides in these hazard zones. This is a high-end estimate based on average population density across the entire administrative area. We did not use the higher density value for the city's developed area, as much of the city's exposure to storm damage seems to be in less-developed coastal areas. However, the city's downtown/port area is a major exception to this rule. It may be that this is a significant overestimate; however, the informal settlements surrounding the city are undoubtedly large. If this estimate

Figure 2.6 Beira proper, estimated flood coverage after implementation of 20135 Masterplan recommendations[150]

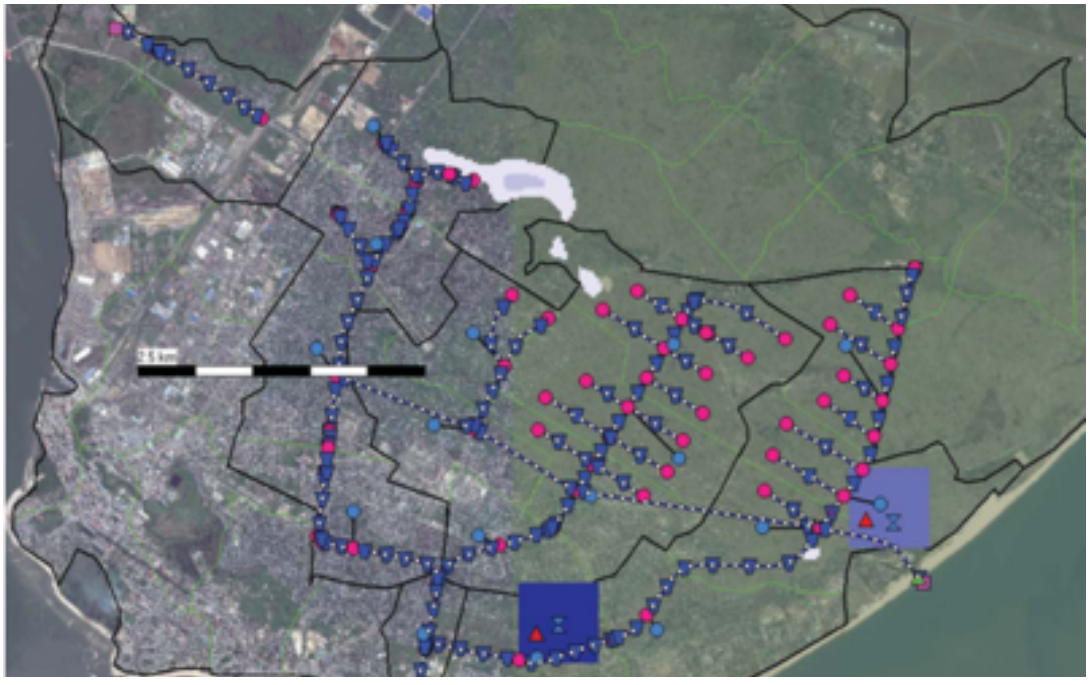


Table 2.37 Summary of Cost Estimates, Coastal Defense and Flood Management for Beira

Details	Cost Range Estimate
Cost estimate for relocation of households in hazard areas.	Low-end estimate (455 households to be relocated): USD 4.1 million to 25.0 million High-end estimate, (34,900 households to be relocated): USD 414.5 million to 2,530 million
Cost estimate for coastal defense measures and flood management infrastructure.	Construction: USD 27 million to 357.9 million

were accurate, it would cost the city between USD 414.5 million (USD 9,000 per unit) and USD 2.53 billion (USD 55,000 per unit) to move these residents.

However, even if the recommended coastal defense measures are implemented (included improved canals and drainage channels, and two retention basins), it will likely still be necessary to relocate a significant number of households to accommodate the two retention basins recommended by the 2035 Beira Master Plan (see image below), as well as to remove residents from remaining flood-affected area. Each retention basin is estimated to be 0.5 square kilometers in size, as is the residual flood-affected area. Therefore, even after coastal defense measures are constructed, we estimate (based on a population density of 1,609 persons/km2) that 455 households will likely need to be relocated at a minimum cost range of USD 4.1 million (USD 9,000 per single family-detached unit) to USD 25.0 million (USD 55,000 per unit for a multi-story multi-family development). While such measures might drastically reduce exposure, it is likely that a significant number of people beyond the 455-household estimate will remain in permanent hazard areas.

2.4.4.2 Accommodating the Future Growth

With regards to coastal defense measures, mitigating unnecessary risk exposure from future growth is likely to be primarily a matter of policy. Active enforcement of development standards and restrictions on the habitation of zones that cannot be adequately protected from extreme weather events will prevent the need for future expenditure on the rehabilitation of infrastructure, relocation of households, and mitigation of otherwise preventable public health crises. Policy should also focus on development or industry in peri-urban areas that may exacerbate problems from climate change. For example, deforestation, which reduces soil water retention, is expected to contribute to future flooding, as larger quantities of rainwater runoff will flow into the rivers around Beira.[151]

Proper safeguarding and management of water resources based on realistic urban growth scenarios will also be essential for ensuring future availability of drinking water. The city and province will have to strike a balance between agricultural, industrial and residential water usage.

2.5 Sources and Status of Finance

In any country, developed or developing, the basic financial sources can be divided into five general categories (Public Expenditure; Public Debt; Public Investment; Private Investment; Donor). However, the breakdown or proportion that each of these sources contributes differs dramatically, where developed countries are led by household expenditure and third-party investments and developing countries are led by public investment, specifically the national government, and donor grants. This is especially true in the case of Mozambique, and the City of Beira.

Table 2.38 MZN/USD Exchange, Inflation, Interest Rates (forecasted from 2016)

	Year							Data Source
Indicator	2010	2011	2012	2013	2014	2015	2016	
Exchange rate (MZN/USD)	33.96	29.07	28.37	30.10	31.35	39.98	63.06	2017 IMF IFS Yearbook
Inflation, GDP deflator (Index)	100.0	103.3	109.4	113.7	116.7	121.8	N/A	2017 IMF IFS Yearbook
Lending interest rate (%)	16.26%	19.10%	16.81%	15.32%	14.80%	14.87%	21.18%	2017 IMF IFS Yearbook

In order to produce the assessment of financial sources in Beira, the study evaluated the budgets of the national and municipal governments, utilities and donors. It further identified private third-party investment where information was available and published. Finally, the study estimated household expenditures by quantifying the reported annual expenditures from the family budget survey against the population figures provided by INE. Household debt was determined by analyzing lending statistic from financial sector reports.

For some categories, it was difficult to determine where household expenditures for infrastructure provided by the public utility. In order to avoid such double counting, the utility expenditure was deducted from the household expenditure.

This section will also provide some general descriptive statistics that paint a clearer picture of the status of finance in Mozambique. The size of local capital market, the Maputo Stock Exchange, is only about USD 1.117 billion.[152] Total credit issued to the economy was only 27.7 percent of GDP in 2012.[153] This increased to 31.1 percent of GDP in 2013, and was projected to grow to 34.4 percent of GDP by the end of 2014.[154] Only 9 percent of total credit in 2012 was allocated to construction/public works projects.[155]

In Mozambique generally, long-term lending in local currency is not prevalent, and interest rates on debt financing in local currency are very high.[156] Additionally, because of volatile inflation and exchange rates, there is significant exchange rate risk inherent in financing in international currency. Mozambique has passed legislation that only allows export-orientated projects to be financed in foreign currency.[157]

The 2011 federal Law on PPPs, Large Scale Projects, and Company Concessions established that each specific government agency (i.e. overseeing water, sanitation, power, etc.) is responsible for managing PPPs in its area of authority.[158] PPP ventures are required by law to make 5-20 percent of shares available to the public for purchase via the Mozambican stock market.[159] The law allows for concessions of up to 30 years for wholly new development projects, with the possibility of a 10 year extension; 20 years for projects involving significant rehabilitation and expansion; and no more than 10 years for small initiatives involving existing infrastructure.[160]

Institutional and legal frameworks for soliciting, developing and managing PPPs are not fully developed; this often results in delays, a lack of transparency in the bidding process, and uncertainty regarding outcomes.[161]

The creditworthiness of the state remains an issue. However, Mozambique sits on vast, varied natural resource reserves that would mitigate many of its cash flow issues if they were properly exploited.[162] Unfortunately, the Mozambican state seems to suffer from a lack of institutional knowledge and experience that would be required to successfully navigate complex project finance and negotiation.[163]

At the municipal level, debt financing is heavily restricted under Law 1/2008.[164] Municipalities are allowed to borrow amounts equal to 25 percent of the amount received from the national government via the Municipal Compensation Fund (an intergovernmental fiscal transfer system). This debt must be paid back by the end of the fiscal year. Otherwise, long-term borrowing from commercial or international creditors must be approved by the Ministry of Finance. This is apparently not a common occurrence.

With regards to the attractiveness of PPPs from the perspective of the private sector, return on investment is often a concern. Tariffs that would be used to provide revenue streams for PPPs are often not reflective of costs due to affordability concerns.[165] In the power sector in particular, this makes the most attractive investment opportunities those that involve power purchasing agreements with foreign buyers in countries where demand is less price elastic (i.e. the project is less likely to encounter revenue issues over the affordability of services).[166]

2.5.1 Housing

Household Expenditure

Household expenditure on housing for low-income residents who can't afford to buy a home outright and don't have the financial resources necessary to apply for a home loan or rent typically takes the form of periodic expenditure on incremental home construction and improvements over the course of a lifetime; this is key characteristic of informal housing. UN Habitat report suggests that average household investment in housing over the course of a lifetime is around USD 15,000.[167]

Reall estimates that 44 percent of households in Beira live in rental housing (i.e. regularly/consistently spend some portion of monthly earnings on housing).[168] Any attempt to build housing based on this assumption of some basic ability to pay should consider that this proportion is likely much lower in reality because the sample constructed for the survey may have consisted of predominantly middle-income households (see cited report). Lease-to-own options have been made available on an extremely limited basis, but mostly in Maputo, by Banco Único and BCI.[169]

A further limiting factor on the financial resources of Mozambique's low-income households is the fact that formal employment in urban areas is estimated at only about 65 percent, and nationally may be as low as 11 percent.[170] Generally speaking, lower income households do not have the financial resources to support a level of expenditure adequate for acquiring formal and/or quality housing via purchase or debt financing.

HH Debt[171]

The lower limit for cheap, priced-near-cost housing tends to be around USD 25,000, which in 2012 would have required a family net monthly income of about MZN 30,000.[172]
Impediments to borrowing include chronically high interest rates, registration and origination fees (which can exceed 8 percent of home values), and deposit/savings or collateral.[173] The minimum commerical bank loan is around MZN 250,000 to 300,000 meaning that very few people in Mozambique have the financial resources to borrow.[174,175]

Government support for the mortgage market is not routine practice but has happened in a few specific cases. Standard Bank of Mozambique reached an agreement with the government to provide mortgages with 90 percent loan-to-value ratios to help facilitate the purchase of homes in a 5,000-unit project in Matola produced though a partnership between the FFH and a Chinese developer.

Mozambique's commercial banking sector consists of 18 commercial banking institutions. In 2012, mortgage lending was only 0.6 percent of GDP or USD 75 million; this was only 2.24 percent of total outstanding loans in 2012.

As of 2013, the number of housing improvement loans had decreased in the previous decade as a result of lending policy changes at many institutions.[176]

The Reall Beira Housing Market Study notes that one of the primary impediments to borrowing against home equity is the fact that many people who claim that they own their own homes have no legal documentation of home ownership (which is granted upon completion by the municipality of a formal inspection).[177] Because the Mozambican state owns all land, it cannot be used as collateral for a loan; therefore, if a household does not have legal documentation of ownership of their home, they have no capital assets to use as collateral. Beyond Mozambique's 18 commercial banks, the sector also includes 8 Microbanks, 7 Credit Co-ops, 166 other Microfinance Institutions (MFIs). MFIs were responsible for a credit market of comparable size at USD 74.1 million; it is not clear what portion of this is specifically housing-related.

Cordero (2013) identified only 5 microfinance institutions in Mozambique that offered a loan product for housing.[178]

Public Investment

The Government of Mozambique has led public investment campaigns for housing construction. However, such initiatives rarely result in truly affordable housing for low-income families. CAHF has expressed to the Housing Promotion Fund (FFH, Government of Mozambique) that their "low-cost" housing development options would be affordable in reality to only 1.7 percent of Mozambique's urban population.[179] FFH has not substantially contributed to the country's low-income housing stock.[180]

The national government implemented a 5-year plan in 2010 in which it committed to build 100,000 houses and zone another 300,000 plots of land for development. Of the new homes, the government committed to building 20 percent, with the remaining 80 percent being allocated between private sector developers (30 percent) and residents constructing their own homes (50 percent). Only 5 percent of these homes were to be fully subsidized.

Inefficiency in administration may be contributing to a slow pace of development.[181] Institutions with jurisdiction over matters related to housing are the direction of the Ministry of Public Works and Housing (MOPH), under which there is the National Directorate for Housing and Urbanisation (DNHU), and the Housing Promotion Fund (FFH). Recently, a third directorate responsible for building materials was added.[182]
Current outstanding policy initiatives include:[183]

- Housing Policy & Strategy – this initiative the declared intent to oversee creation of 100,000 new homes by 2014
- Housing Action Plan – related to Housing Policy & Strategy; it is a plan create 20,000 homes as a result of government projects, and the rest (80,000) via private investment and self-construction.
- Slum Upgrading Strategy (2010) – this strategy is part of an ongoing effort to prevent the growth of slums and update current slums.
- Financial Sector Development Strategy (2012-2020) – this strategy involves the general development of national financial markets, including those related to housing.

Public Debt

There is no substantial public sector borrowing in Mozambique on the part of municipalities. In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[184] Additionally, constraints on the level of public debt are necessary to avoid solvency issues with respect to public/municipal institutions.

Private Investment

A major proportion of private investment in Mozambique comes in the form of foreign direct investment, though local housing development firms also operate in Beira. Real

estate construction is mostly undertaken by foreign entities and the vast majority of new construction caters to high-income homebuyers.[185,186] The sale prices on these homes put them beyond the means of middle- and lower-income Mozambicans.

Public-Private Partnerships are largely implemented through FFH.[187] Projects undertaken as joint ventures between the Government of Mozambique and private developers include:

- An agreement in 2011 with a Chinese firm to build 5,000 homes in Matola, with a follow-on arrangement to provide 5,000 additional homes across the country.
- An agreement with a Spanish firm to provide 4,500 homes across three provinces
- An agreement in 2013 with the Indian government which included a USD 217 million line of credit for the purposes of financing public works projects, including 1,200 homes across three provinces.
- A 2013 initiative alongside Charlestrong Engenharia, Tecnologia e Consultoria, Ltd., to finance the construction of 50,000 homes at a total price of USD 5.5 billion.[188]

Donors

A 2010 CAHF Housing Finance report noted that the Joaquin Chissano Foundation (Mozambique) financed a USD 100 million project consisting of 1,836 homes in Maputo.[189] We were unable to find data on similar initiatives in Beira.

2.5.2 Transport

HH Expenditure

Household expenditure on transportation takes several forms across Mozambique; these include purchases of vehicles and fuel; use of public and private transportation services; and payment of toll road fees, taxes on fuel, and taxes on vehicle ownership.

Toll roads have been successfully implemented, but the affordability of tolls for commuters has been a point of contention.[190] In 2009, vehicle taxes in Beira only amounted to 4.9 percent of municipal revenues; while rates of vehicle ownership in Beira are likely not substantial, there is probably some room for growth.[191]

HH Debt[192]

Mozambique has a substantially developed microfinance market. Household debt would likely take the form of a small loan for the purpose of purchasing a vehicle. We were not able to determine how prevalent this practice is nationwide. The previously cited 2009 FinScope report would seem to indicate that at the time of the report, only 0.2 percent of the respondents to the survey who had indicated patronage of services in the formal banking sector (11.8 percent of people nationally) had used banking services for the purpose of leasing or purchasing a vehicle. If nationally representative, this would amount to less than 7,000 vehicle-related loans nationally.

Public Investment

The municipal authority in Beira is responsible for the construction and maintenance of municipal roads, and consults with the federal government regarding national roads that exceed the boundaries of the municipal government's jurisdiction. Municipal public debt is extremely restricted; therefore, all investments in transportation infrastructure likely paid for via direct expenditure of tax revenues. Total tax and non-tax revenues for Beira according to section 1.7.3 in 2015 amounted to roughly MZN 793 million or about USD 20 million, assuming a rough exchange rate of 40 MZN/USD in 2015. Current expenditure on road maintenance (derived from tax revenues) appears to be about USD 300,000 (again using a 2015 period avg. exchange rate of 40 MZN/USD).[193]

The National Roads Administration (ANE), subordinate to the Ministry of Public Works, is the federal entity responsible for managing primary and secondary roads in conjunction with the municipality within whose jurisdiction

the roads fall.[194] The federal government additionally subsidizes both public and private operators, via purchasing assistance for new buses and (for private operators) fuel rebates.[195]

Public Debt

There is no substantial public sector borrowing in Mozambique on the part of municipalities. In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[196]

Private Investment

A major local private sector infrastructure developer is CETA-Insitec (Mozambique, roads and bridges).
Privately operated mass transit and toll roads are not uncommon in Mozambique. Construction and operation of toll roads by private sector entities has successfully led to development.[197] The affordability of toll road usage by commuters is a concern.
Public-Private Partnerships to date have largely focused on transportation infrastructure vital to commerce, specifically railways and ports, with mixed levels of success.[198] PPPs in conjunction with CfM (the national port/railway authority) that were in the negotiating phase as of 2015 were:[199]

- Moatize-Macuse Port/Railway project (USD 4.5 billion); Vale SA (Brazil); Mitsui (Japan)
- Nacala Corridor Port/Railway Project (USD 4.4 billion); Italthai Engineering (Thailand)
- Beira Port Coal Terminal (USD 25 million); Essar Group (India)
- Maputo-Catembe Bridge (USD 755 million), in conjunction with Chinese EXIM Bank, China Roads & Bridges.[200]

Many of these projects have been to rehabilitate existing infrastructure rather than to build entirely new infrastructure; this should incentivize Government of Mozambique to be creative in offering new development and investment opportunities to private entities.

Donors

Data was not found for donor finance in this sector.

2.5.3 Energy

HH Expenditure
We estimate based on family budget survey that the average household expenditure on all energy sources is MZN 652 per month, representing 5.27 percent of monthly household expenditure on average.[201] This would indicate that total annual expenditure on all energy sources in Beira (115,000 households) is MZN 899,760,000; at 2014 exchange rates, this is roughly equal to USD 29.99 million.

A 2012 EDM (national utility provider) statistical summary estimates 1.05 million domestic household clients, leaving a national demand gap of about 4.2 million households (assuming an average household size of 5.3 persons.[202]

In Beira, we estimate that the demand gap is currently 62.3 percent of households (or over 70,000 households without access to quality power sources). We currently estimate that EDM's revenues from Beira's roughly 35,500 grid-connected households amount to roughly MZN 130,000,000 (avg. monthly expenditure on electricity of MZN 300 per grid-connected household); at 2014 exchange rates this is roughly USD 4.2 million.

HH Debt[203]

It is unclear to what extent possibilities in this area have been considered. This would likely be a decentralized approach to energy provision, perhaps involving the provision of credit by microfinancial, commercial, and government lending institutions for the purpose of investing in household generators or solar panels, or mini-grid systems at the neighborhood level.

Public Investment

EDM is the national power utility provider. In 2008, EDM facilitated an USD 80 million (100,000 connections) investment in household connections, of which USD 60 million was financed by donors.[204] FUNAE is the federal agency tasked with providing financial aid for investment in novel and renewable methods of off-grid energy provision. Its focus is primarily on rural electrification.

Opportunities for investment in this sector are lucrative. Mozambique has the 3rd largest proven natural gas reserves in Africa, and has a substantial estimated capacity for hydroelectric power generation of 60,000 GWh/year.[205]

Public Debt

Regional commercial banks, and multilateral financial institutions often provide debt financing to the Government of Mozambique for major infrastructure investments. For example, Gigawatt Project (100MW gas power production) was constructed with USD 160 million in debt financing from Standard Bank of South Africa, contingent upon the project being insured by the WB Multilateral Investment Guarantee Agency.[206]
In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[207]

Private Investment

1997 Electricity Act opened energy production up to private operators, but this has happened primarily in the petroleum industry, while EDM remains the primary provider of electricity across the country.[208]
Hydroelectric of Cahora Bass (HCB) is one of the country's major power producers; it is unclear to what extent it is privately owned. HCB operates hydroelectric dam on Zambezi river that generates 2,075MW, sells to state utility EDM.[209] Mozambique appears to export most of the power generated in the country. Therefore, the largest issues in meeting demand are not supply related, but instead have to do with grid coverage and affordability.

There are many other Independent Power Producers (IPPs) and Public Private Partnerships (PPPs) operating in the energy sector. Some examples are:[210]

- Mphanda Nkura hydroelectric plant on Zambezi River, which has an expected generation capacity of 1500 MW. Shareholders include Camargo Correa Construction (Brazil); Insitec (Mozambique); EDM (financing via African Development Bank).
- Moatize IPP, a 600 MW coal-thermal power production plant, financed by a multi-stakeholder investment of USD 1 billion. Partners include Vale SA (Brazil, multi-sector), and Whatana Investment Group (Mozambique, multi-sector).
- Ncondezi (Mozambique) 300MW coal power production which involved a USD 600 million investment in partnership with Shanghai Electric Co. (China)
- Temporary gas-powered plant operated by Scottish Aggreko.

Donors

Various Multilateral and Sovereign Development Institutions have acted as donors in the energy sector. In 2008, the World Bank, AfDB, and development agencies of Sweden, Norway, Denmark financed USD 60 million of the USD 80 million investment in the aforementioned EDM initiative to expand service coverage.

2.5.4 Water

HH Expenditure

We estimate that annual revenues from domestic, grid water connections are roughly MZN 194 million, based on current coverage and provision estimates and an estimated avg. monthly household expenditure of MZN 300.[211]

However, we estimate a current coverage gap of roughly 60,000 households in Beira.

As detailed in section 2.4.1, FIPAG AO Beira successfully invoices based on meter readings at a stable rate greater than 95 percent (for networked connections), although estimates of the rate of bill non-payment are as high as 30 percent.

HH Debt[212]

In the water sector, debt might take the form of microfinancial, commercial, or government lending institutions providing small loans to cover the costs of individual household water grid connections or water collection systems. This study found no evidence that any such lending takes place.

Public Investment[213]

In the public water sector the Ministry of Public Works and Housing - National Water Directorate (DNA) is the lead agency. Within the public sector, subordinate institutions include the CRA (Council for the Regulation of Water Supply Services); the ARA (regional water basin regulatory agencies), and FIPAG (Water Assets and Investment Fund), which is responsible for water infrastructure investment and service provision. Based on data in section 1.7.3.4 of this report, FIPAG AO Beira recently ran an annual revenue surplus of over MZN 77 million. The CRA is the national-level water and sanitation regulator responsible for setting tariffs. CRA transfers 40 percent of tariff revenues to the Treasury; it is not clear how this money is invested.

Public Debt

It is not clear whether the Government of Mozambique makes use of debt financing for major investments in the water sector.
In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[216]

Private Investment

One of the mandates of FIPAG is to oversee the privatization of water utilities. There are not, however, any private water providers in Beira.[218]

Vitens Evides International (Netherlands) has recently partnered with the municipal government in Beira to address problems in the drinking water supply network. Vitens Evides estimates that roughly 43 percent of households do not have access to drinking water. Their project seeks to rehabilitate the main transport pipe, replace 23 kilometers of faulty, leaking pipe, restructure another 112 kilometers of the network, and add 85 kilometers of new network.[219] It will additionally seek to expand distribution capacity, repair meters, and increase tariff collections. The total value of the contract is EUR 6.5 million.

Donors

In the budget summary spreadsheet, a EUR 7.5million donation to FIPAG AO Beira is listed for FY2015, from an unspecified source and for an unspecified purpose.

2.5.5 Sanitation

HH Expenditure[220]

Household expenditure on sanitation services primarily takes the form of a 15 percent sanitation surcharge on municipal water bills which is intended to cover the operating costs of the city's sewer system. Of the revenues collected from the surcharge, 20 percent are retained by the service provider FIPAG, and the remainder is transferred to the municipal government (CMB).[221] SASB is the local wastewater management utility provider. It is not clear whether CMB provides sanitation services to non-sewered households.[222]

The 2012 report cited here on sanitation surcharges asserts that this tax is levied only on water-connected households in the city's center (which only encompasses about 45,000 people, or approximately 8,500 households).

If this characterization of the sanitation tax is accurate, then based on an avg. monthly household expenditure on water of MZN 300, this sanitation tax only generates about MZN 4.6 million in revenues annually from sewer-connected households. [223]

A SASB budget document from estimates 2015 revenues at MZN 17.5 million[224], which would suggest revenue collection from around 32,000 households. This is larger than our estimate of the extent of SASB's waste management service provision, but it is substantially smaller than FIPAG's water distribution. There may have been a recent effort to expand collection of the sanitation surcharge from water utility customers, or SASB may generate additional revenue from fees, such as charges for emptying septic tanks.

Beyond a dedicated tariff or other funding instrument, it is common practice for sanitation providers to charge a fee to connect a household to the sewer grid.[225] In section 2, we estimated the cost of this service at USD 816 per connection on average. However, this would represent a massive (and likely impossible) expenditure for a typical Mozambican household, and so it is not clear whether the city is routinely able to successfully collect this fee.
It does not appear that the municipality spends any significant portion of its sanitation funds in low-income, non-sewered areas.[226]Despite deriving revenues from several sources, and having extremely limited service coverage, SASB nonetheless operates with a substantial budget deficit.

HH Debt[228]

Household debt in this sector would take the form of microfinancial, commercial, and government lending institutions issuing small loans to cover the costs of individual household investment in sanitation infrastructure (such as septic systems and latrines). This is likely to fall within the category of home improvement construction for low-income households.

Public Investment[229]

Expanding sewer service to unconnected communities remains responsibility of the municipality.[230]It does not appear that the municipal sanitation authority SASB is making any substantial effort to expand city sewer coverage. [231]

The situation in Beira - that is, the fact the SASB is an independently managed municipal agency with its own budget that is financed (at least in part) by a dedicated tariff – is somewhat uncommon for under-resourced municipalities.[232] However, SASB still lacks the funding necessary to successfully address its responsibilities. It is unclear whether SASB budget is supported by transfers from local or national government. However, this report implies that little, if any funding is provided by the national government.[233]

AIAS, (national Water and Sanitation Infrastructure Management Agency) was created in 2009 in conjunction with the World Bank and Millennium Challenge Corporation and is responsible for investment in water supply and sanitation in small- and medium-sized cities.[234]

Public Debt

It is not clear if any major sanitation infrastructure initiatives have been financed via public debt.
In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending. [235, 236] By policy, municipal debt is highly restricted to avoid creating solvency issues for local governments.

Private Investment

Private sector sanitation service providers are not uncommon throughout the region. A decentralized, private-sector approach has

been successful in other cities; in Tanzania, private sector competition amongst waste/ septic management providers has reduced fees to USD 3.75 per trip, with same-day service.[237]

Currently, sanitation services and infrastructure in Beira are managed by a municipal department. Further market research would be necessary to determine whether there are any lucrative opportunities for private sector investors and developers.
Donors

Beira was able to solicit EUR 63 million in European Union funding for the construction of the current sewage treatment works that service the city.[238]

The World Bank Water & Sanitation Program has been active in Maputo providing guidance to the local authorities.[239]

2.5.6 Solid Waste

HH Expenditure[240]

In Beira, it is unclear whether there is any specific policy instrument dedicated for raising revenues for solid waste management services. An expenditure category in 2015 municipal budget lists MZN 34,425,000 (roughly USD 860,000) spent on "Collect, deposit and treatment of waste" (see 2.4.3.1)

In Maputo, policy instruments dedicated to raising funds for waste management include a tariff on electricity consumption, as well as a dumping fee at landfills. These instruments generated USD 2.1 million in revenue in 2012.[241] The flat-rate tariff on electricity consumption ranges from MZN 10 for consumption below 100 kWh to 80 MZN for consumption above 500 kWh.[242]

We estimate that the average electricity-connected household in Beira consumes just under 100 kWh of electricity per month. Therefore, we estimate that a fee structure similar to what exists in Maputo would generate at least MZN 4.25 million per year in revenues at current coverage levels. Such a tariff would at least aid in addressing the current demand gap outlined in Section 2.4.3.

HH Debt [243]

It is unclear how debt financing might address household solid waste management solutions.

Public Investment [244]

The municipal solid waste management authority in Beira is estimated to successfully manage about 75 percent of the city's solid waste.[245] Many municipalities opt for private sector service providers to close coverage gaps; this appears to be the case in Beira.[246] Solid waste seems to be disposed of primarily via landfills. Public investment in this category might address expansion of service, the use of new technologies to reuse or cycle materials or attempts to capture the natural gas created as a byproduct of waste decomposition.

Public Debt

Debt financing in this sector might address expansion of service, the use of new technologies to recycle materials, or attempts to capture the natural gas created as a byproduct of waste decomposition, all of which might help improve long-run profitability.
In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[247]

Private Investment

Terra Nova is a local organic waste management service provider established in 2009 that makes compost to supply to local farms)[248] It does not appear that Terra Nova invests in or contributes to collection efforts.

It is estimated that 65 percent of the solid waste generated in Beira is organic and can be

composted. If this proportion is accurate, it may be that as much as 100,000 tons of organic waste are produced in Beira each year. Terra Nova's operational goal is the management of only 9,000 tons of waste (which would create roughly 2,800 tons of compost).

With a waste-to-compost conversion rate of 31 percent, Beira has the potential to produce up to 31,000 tons of compost for agribusiness. At an estimated price of USD 130/ton[249], this has the potential to generate revenues in the area of USD 4 million per year.

Many municipalities have opted for private sector service providers in the solid waste management sector, with the largest providers being from Portugal and South Africa.[250]

Donors

It is unclear whether donor funding has been solicited for investment or consulting in the solid waste management sector.

2.5.7 Flood Management

HH Expenditure

The recurring maintenance and operation costs associated with the proposed investment in drainage infrastructure as part of the World Bank's Cities and Climate Change Project are estimated at USD 150,000; these costs are to be financed with a drainage fee equal to 15 percent of property tax.[251] See Household Expenditure section.

The previously cited report estimates that total revenues for this purpose transferred from property tax collection in 2010 amounted to roughly USD 55,000 and so would have to roughly triple in size by the time the investments were completed in order to fully cover the operations/maintenance expenses.

HH Debt

It might be prudent to explore the feasibility of microloans in this sector for household-level resilience measures, especially if local and federal government are concerned with the economic risk exposure of the city's housing stock due to extreme weather events.

Public Investment

The Government of Mozambique, in conjunction with the World Bank Cities and Climate Change Project, has pledged to rehabilitate 10km of open-air drainage channels (roughly 1/3 of open channels) at an estimated cost of USD 62 million.[252]

Public Debt

Investment in climate resilience and coastal defense measures is integral to the survivability most other infrastructure investment. High-end cost estimates for the full range of coastal defense infrastructure in Beira exceed USD 350 million.

In Mozambique generally, a major impediment to debt financing is macroeconomic instability; inflation is generally high year-to-year, and so nominal interest rates remain prohibitively high in most cases, especially for long-term lending.[253]

Private Investment

Incentivizing private investment in coastal defense infrastructure is complex; it is difficult to derive revenue streams from coastal defense investment. Possible solutions in this sector might include risk transfer mechanisms such as mandatory flood or disaster insurance, or tax incentives for climate resilient construction, which might in turn make investment in risk mitigation measures more cost-effective.

Donors

In Mozambique, the World Bank Cities and Climate Change Project, via Pilot Program for Climate Resilience (PPCR), implemented an effort to improve natural rain/floodwater mitigation infrastructure valued at USD 15.75 million.[254]
UN Framework Convention on Climate Change – Green Climate Fund (GCF) was created for the

purpose of funding climate change mitigation and adaptation efforts.[255] It is estimated that in 2012, funding flows for these purposes from developed to developing countries were in the range of USD 40-60 billion.[256] The Global Environment Facility is another contributor to the UNFCC.

The Climate Investment Funds are a joint initiative by the World Bank, African Development Bank, and others. Mozambique has already received USD 86 million in grants from the Pilot Program for Climate Resilience, a component fund of the Climate Investment Funds
Additional Initiatives, via various sovereign and multilateral investment institutions include:[257]

- Rehab of coastal protection (Switzerland)
- Early Warning and Emergency Response (GIZ)
- Rehab of sanitation/drainage (European Investment Bank, GIZ)
- Drainage System Management (Nordic Development Fund)
- Chiveve River Management (KfW)

The impacts of climate change in Beira are already apparent, primarily in the form of costal erosion and inland flooding. Reports from INGC, the lead entity responsible for assessing risk due to climate change, forecast that 5 meters of coastline are lost each year due to erosion. Air pollution, liquid and solid waste pollution, and environmental degradation also pose significant health risks to the general population. Increasing prospects of drought and saltwater intrusion loom as threats to the drinking water supply.

The following section will identify the financing needs to mitigate or adapt to the impacts of climate change, but also lead to a more resilient, green and competitive economy where households and business spend less on infrastructure services and decrease their economic and financial liability to potential shocks caused by climate change. Many of these solutions are integrated and might include multiple sectors.

Note, not all Green Urban Solutions are mutually independent. One solution might reduce or eliminate the need for another. In a similar fashion, not all Green Urban Solutions are mutually independent of the traditional infrastructure investments presented in section 2. Therefore, after analyzing each individual intervention, a portfolio analysis must be completed.

In Mozambique, the institutional commitment to a green and sustainable future is strong, and reflected in the nation's various policies and strategies that guide development. Some of these are listed below:

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- Solid Waste Management Regulations (2006) allows municipal authorities the latitude to effect policy and economic instruments as needed to regulate and fund the management of solid waste, subject to MICOA approval.

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that authority specifically as it relates to the establishment and use of economic instruments and public funds, and outlines the services that a municipal government is responsible for providing to its constituents.

Other existing and past policy frameworks include:

- The 2005-2015 Environmental Sector Plan
- The Environmental Strategy for Sustainable Development of Mozambique.
- The Strategy for Integrated Municipal Solid Waste Management in Mozambique is a strategic plan for the development effective municipal-level solid waste management (in terms of both institutional capabilities and infrastructure) by the year 2025. It intends to solicit cooperation of and organize local and regional governments, laborers, and private sector partners
- The 2012 National Strategy for Climate Change Adaptation and Mitigation seeks to integrate strategic approaches across sectors, and explore how adaptation, mitigation and resilience strategies can promote socioeconomic development in spite of climate change.

The broad goals outlined under Mozambique's National Adaptation Plan of Action include :

1) Improving of early warning systems
2) Incorporating climate resilience into development planning across sectors
3) Promoting of public education
4) Exploring avenues for mitigating disaster risk

The World Bank estimated in 2010 that absent any attempt to mitigate the impending consequences of climate change, Mozambique stands to experience economic losses in excess of USD 400 million beginning sometime in the decade between 2030-2040. The cost of reconstruction work required in the aftermath of a major flood in 2013 was estimated to be roughly USD 500 million. Climate change poses myriad threats across sectors; a graphic borrowed from a 2009 UN-Habitat report provides a general overview of below:

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Chapter 3

Green Urban Solutions

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mitigation and resilience strategies can promote socioeconomic development in spite of climate change.

The broad goals outlined under Mozambique's National Adaptation Plan of Action include:[262]

1) Improving of early warning systems
2) Incorporating climate resilience into development planning across sectors
3) Promoting of public education
4) Exploring avenues for mitigating disaster risk

The World Bank estimated in 2010 that absent any attempt to mitigate the impending consequences of climate change, Mozambique stands to experience economic losses in excess of USD 400 million beginning sometime in the decade between 2030-2040.[263] The cost of reconstruction work required in the aftermath of a major flood in 2013 was estimated to be roughly USD 500 million.[264] Climate change poses myriad threats across sectors; a graphic borrowed from a 2009 UN-Habitat report provides a general overview of below:

Table 3.1 Climate Change Vulnerabilities by Sector[265]

Sector or Area	Climate Change Event	Impact
Coast Zone & Ecosystems	Tropical Cyclones	Damage to coastal infrastructure, dunes, beaches, etc.
	Sea Level Rise & Storm Surge	Increased erosion or damage to coastal infrastructure, dunes, beaches, etc.
		Loss of coastal wetlands and other coastal habitats
		Increased costs for maintenance and expansion of coastal erosion control
		Saltwater intrusion into freshwater bodies
		Increased risk of pollution from flooding of hazardous waste sites
		Reduced effectiveness of sea walls
Transportation system	Variations of temperature and heavy precipitation	Increased damage to roads and bridges
		Increased maintenance requirements for same
Wetlands and Urban Agriculture	Heavy precipitation	Increased risk of flooding
	Dry season	Crop failures, water scarcity, drying of water reservoirs and increased demand for water for irrigation
		Increased risk of habitat loss, salt intrusion
Human Settlements and Infrastructure	Tropical Cyclones	Housing and infrastructure damage
	Heavy precipitation	Housing and infrastructure damage
		Need for new or upgraded flood control and erosion control structures
		Landslides, road washouts and flooding
		Increased demands of storm water managements systems and sewer outflows
	Sea level rise	Reduced effectiveness of sea walls; housing and infrastructure damage
Health, food and waste management	Heavy precipitation	Increase in vector-borne diseases
		Need for a new waste collection, management and treatment system

The Green Economy Roadmap for Mozambique was produced in response to the Rio+20 (2012 UN Conference on Sustainable Development)[266]; it highlighted the objective of the Government of Mozambique to develop the country into a middle-income nation within the context of environmental sustainability.

It listed as its objectives social justice, reduction of poverty, and investment in green jobs and technologies. The major components of the roadmap are Infrastructure (Transportation, energy, urban development); Natural resources (water, forests, agriculture, fisheries, tourism, other commodities); and climate resilience and adaptation. They are elaborated below:

Strategies for sustainable urban development

1) Tax incentives for the production of low-income housing in low-risk areas
2) City-level long-term strategic development planning in anticipation of high rates of urbanization and increasing climate change risk
3) Enacting energy efficiency standards for new development
4) Establishment of PPPs in municipal service sectors (sanitation, transportation, etc.)

Strategies for sustainable transportation sector development

1) Development with social inclusion and community integration as a primary focus (e.g. improving access of agricultural and low-income communities to developed areas).
2) Development of infrastructure essential to commerce
3) Reducing climate vulnerability of transportation infrastructure
4) Implementation of affordable and environmentally friendly public mass-transit systems
5) PPPs in support of transportation infrastructure development
6) Tax incentives for investment in green transportation technologies
7) Introduction of duties to international commerce earmarked for investment in climate-resilient transportation infrastructure

Strategies for sustainable energy sector development

1) Seeking to increase exploitation of vast energy reserves (natural gas, hydropower, etc.), and improve upon green/sustainability energy access. For example, 12 percent of Mozambicans with electricity access make use of solar energy.
2) linking energy, land management, natural resource, and agricultural sectors to promote a holistic approach to environmental sustainability.
3) Creating tax and loan incentives for projects that proliferate sustainable, clean and renewable energy.
4) Supporting the construction of decentralized energy provision, including household and mini-grid systems, for the purpose of improving access to quality energy.

Strategies for sustainable water and sanitation sector development

1) Integrated management of water usage across sectors
2) Investment in infrastructure to guard against water shortages
3) Establishment of PPPs in the water and sanitation sectors
4) Initiatives to reduce water loss and to recycle wastewater and storm water.

Mozambique intends to finance these initiatives in part via income derived from an investment portfolio established under a Green Economy Investment Fund, with the initial investment capital coming from levies on extractive industries

3.1 Financing Needs

3.1.1 Green Housing

As mentioned in previous sections, there is significant demand and financing need for the

improvement of Beira's existing housing stock, as well as for the accommodation of future growth. In addition, to these demands, there is a need for finance in the effort to address the impacts of climate change in the housing sector. The impacts are primarily related to the damage caused by flooding and erosion to homes and household assets.

The available options for intervention in the housing sector include:

1) Upgrading or climate proofing households in hazard zones,
2) Resettlement of households located in hazard zones,
3) Upgrading coastal defenses and improvement of drainage, and
4) Establishment of conservation and restricted development zones and directing growth towards "safe zones."

In addition to the public health hazard and investment challenges that they represent, Beira's poor informal settlements also pose a massive strategic and logistical challenge. The exact sizes, locations and configurations of these informal settlements are often not officially documented, and consequently they can often obstruct or delay attempts by the city and developers to plan for or implement a project.[267]

The scenario that places Beira most at risk involves a combination of progressive, long-term mean sea level rise, seasonal fluctuations in sea level, and increasing frequency and severity of weather events.[268] Given the current state of coastal defense, quasi-permanent (i.e. extremely frequent) spikes in sea level of 5m or greater over the course of the 21st century would expose central/downtown and much of coastal Beira to extensive flooding.

In the event that this renders 10% of the city (or 63.1 square kilometers) permanently unsuithouseholds (967 persons/km2), and 101,528 people or 19,156 households (1,609 persons/km2).

Beira; A deteriorated groyne[269]

For the purposes of analysis, we will conceive of "green" and self-sufficient single-family detached home that is small in size but of robust construction, and includes a solar panel connection (USD 1,000 est. cost); a safe, modern latrine (USD 500 est. cost); and a rainwater recycling system (USD 1,000).[270] We estimate the total cost of construction of such a home at a minimum of USD 12,000 per unit.

At this price, the cost of moving 11,500 households into hazard-free areas would be around USD 138 million; the cost of moving 19,160 households would be USD 230 million. It is important to note however that the cost to the city of this land being rendered unusable is much greater than just the cost of the area's housing stock; downtown/central Beira is one of the city's wealthiest and most developed zones.

In the case of perpetual flooding, climate-resilient construction is not by itself a feasible mitigation solution. Thus, climate-resilient housing is not an especially useful investment without complementary investment in coastal protection.

Because of the future risk of flooding and extreme weather events, the INGC report suggests that future development should be directed towards areas that are 8 meters or more above mean sea level.[271]

3.1.2 Green Infrastructure

Green infrastructure is a term that can encompass a wide variety of specific practices. Generally, it is considered an approach to environmental management and infrastructure development that protects, restores or mimics the natural ecosystem and related functions such as absorption and filtering of storm water, and recharge of natural aquifers and groundwater sources. Other examples include air quality filtering and erosion control.
Other important terms include low-impact development strategies (LIDS), which are even broader and can even include infrastructure that decreases environmental impacts from GHG emissions or solid and sanitation waste pollution.

The introduction of these types of green and LIDS infrastructure can significantly increases the resiliency of urban areas, and their ability to contain or decrease the magnitude of climate change shocks from direct consequences like extreme weather, sea level rise and associated damage and flooding, and secondary impacts like health and natural resource scarcity.
An analysis of the provision of green infrastructure is provided below, including cost estimates where available.

Coastal defense

Measures include:
- Reforestation to improve water/soil retention of natural landscapes[272]
- Management of coastal wetland, mangroves[273]
- Vegetated/naturally reinforced dunes (up to USD 7.2 million/km)[274]
- Groynes (rock/concrete), revetments, dikes (i.e. natural barriers/structures to prevent flooding and coastal erosion) (up to USD 29.2 million/km)[275]

The maximum cost estimate of climate change-related risk mitigation measures in Beira is USD 357.9 million. These measures still do not address the entirety of Beira's risk exposure, some of which cannot be mitigated via infrastructure investment.

Drainage

Measures include:
- Rehabilitation of current network of drainage channels (clearing of debris and vegetation)
- Construction of two retention basins of 50 hectares within the current drainage area
- The 2035 Beira Master Plan also includes exploration regarding the construction of a third retention basin of 100 hectares east of the airport, along with the implied extension of the current drainage network
- Improving Soil Water Retention/ Forest Conservation efforts

Beira; Coastal erosion, northeast coastline[276]

The portion of the 2035 Beira Master Plan that specifically addresses Beira's drainage system estimates the cost of network expansion and rehabilitation at approximately USD 90 million (see Appendix B).

Renewable Energy

There are multiple national government-level stakeholders in this sector. They include: The Ministry of Energy (energy sector management); the Ministry of Agriculture (management of forestry resources); Ministry for the Coordination of Environmental Affairs (environmental protection).

FUNAE is the government entity responsible for exploring opportunities for decentralized, off-grid, and novel forms of energy production and provision. It is involved in project consultation/conceptualization, finance, and implementation, and for various types of fuel sources and provision methods.[277] Its responsibilities include examining opportunities to invest in efficient and renewable energy sources. As the report notes, the organization likely does not have the requisite experience, and is likely not adequately staffed nor adequately funded to effectively address such an exhaustive list of responsibilities.[278] It would likely be a prime target for organizational assistance and reform.

The 2008-2012 Energy Management Strategy for the Energy Sector emphasized:

- Sustainable access to energy sources
- Sustainable use of wood resources
- Energy diversification
- Holistic approaches to energy and infrastructure development
- Tariff revision
- Environmental protection

Much of the electricity already produced locally and distributed to Beira comes from hydroelectric production facilities. Nationally, Mozambique's endowment of hydroelectric generation capacity has been estimated at 60,000 GWh per year (for reference, EDM estimated that total national power distribution in 2012 was 3,336 GWh).[279,280]

We recommend the exploration of solar energy as a decentralized option for electricity production in Beira. Solar panels have proven to be effective sources of electricity, though they are not widely used.[281] A solar panel system such as the one cited here would be sufficient

to supply power to 20 households based on the average usage statistics previously cited, and therefore represents an initial investment of roughly USD 1,000 per household.[282]

It would be decentralized approach to power production that would not force EDM to consider options for increasing the production capacity of existing facilities or increasing purchases from third party producers. The system would additionally retain the components necessary to allow EDM to connect the panels to the larger grid on an incremental basis in the future. We estimate that the cost of meeting the current electricity demand gap in Beira via solar panel systems would cost approximately USD 69.3 million. This analysis estimated the cost of meeting the current demand gap via conventional grid connections at USD 57.3 million.

Decentralized, green, and sustainable energy solutions will be necessary to meet electricity demand both nationally, and in Beira specifically; it is not realistic to expect that Mozambique will be able to afford to develop its central electricity production and distribution capabilities to close the demand gap in the short run.[283]

Energy Efficiency

Many households in Beira do not have access to grid electricity, and therefore are reliant upon other less-efficient sources of energy. There are significant opportunities in this sector to decrease both the environmental impact of non-green energy sources, and to realize savings for low-income families.
Measures include:

- Improved, energy efficient stoves[284]
- Electrification

We estimate the cost of an energy-efficient pellet stove at roughly USD 2,000 per unit. Converting Beira's organic solid waste into briquettes that can be used as fuel additionally presents an opportunity for the city's solid waste management sector to generate revenue and recover costs.[285]

Grid electricity also presents significant savings in annual energy costs; this 2010 report estimates that households operating kerosene lanterns incur costs of about EUR 22 per year, while a similar number of light-hours would cost EUR 3.70 annually if provided by an incandescent bulb, and EUR 1.08 if provided by a fluorescent bulb.[286]

Water

It is estimated that over half of Mozambique's water resources originate outside of its borders; thus resource security and sustainability will necessarily be an important component of any strategic development plan for the water sector.[287] It is estimated that the aggregate economic impact of water shocks (floods and droughts, fluctuations in rainfall) over the period 1981-2004 was USD 1.75 billion.[288] Additionally, these shocks disproportionately affect the country's poorest residents, who rely heavily on agriculture for their livelihood.[289]
Measures Include:

- Wastewater recycling – (irrigation)
- Rainwater harvesting – (drinking water, irrigation)
- New Reservoirs

The report cited here estimates that a typical rainwater collection system would cost roughly USD 1000 per unit.[290] Because the price of a water grid connection is estimated at MZN 2000 per household on average, the rainwater system is likely only cost effective for households in areas that are substantially far from the existing grid.
Finally, a partial solution to this problem might include the construction of fresh water reservoirs sourced from rainwater, and strategically placed to serve areas far from the existing grid. This would reduce the stress on the current treatment works, which sources from the Pungue. There may additionally be some resilience value to creating secondary sources that are compartmentalized and apart from the main distribution grid.

Spending in the water sector nationally amounted to about 1 percent of GDP in 2008.[291]

High rates of urbanization combined with inadequate spending on the development of water infrastructure led to a decline in the first decade of the 21st century in the proportion of households with access to high quality water sources.[292]

Additionally, in 2008 almost 76 percent of expenditure in the water sector was the product of donor-funded development.[293] This is not sustainable; it neglects to address the sector's high recurring maintenance and operations, and makes Mozambique vulnerable to macroeconomic or political events that precipitate sudden changes in the amount of donated foreign aid and foreign direct investment.[294]

Waste Points and Latrines

The primary concern in this sector regards public health. Often, substandard methods for controlling human waste can lead to the contamination of water sources, which increases the incidence of disease. The focus in this sector should be primarily on safe disposal of human waste. This means investment in modern waste disposal systems (latrines, sewer connections, and septic systems), as well as the development of public and/or private service providers who can dispose of human waste in a safe and timely manner.

There are, however, green technologies that can be applied in this sector. We will divide these into central, industrial-level applications, and decentralized, household-level applications. Among the first category are ultraviolet (UV) wastewater treatment and greywater recycling systems; each would be compatible with the spirit of the with environmental priorities of the national legislation and strategic frameworks detailed at the beginning of chapter three, and the latter may serve to reduce stress on freshwater resources. Cost estimates for such systems would be ascertained via professional consultation to determine the municipality's unique needs, and so are beyond the scope of this report.

Household-level, decentralized solutions include single-unit greywater systems and self-contained, above-ground, waterless, composting toilet systems that have obvious advantages for poor communities like those in Beira that often take part in subsistence farming; that must be conservative with potable water; and that exist at sea level and are consequently prone to flooding. Readily available consumer products range substantially in cost and technology; perhaps the most cost-effective application of such a technology would be in publically-managed condominial (street- or neighborhood-level sanitation facilities).

The general safety or cost of such practices would need to be evaluated before reaching a conclusion regarding their suitability for application in Beira.

Solid Waste

Methane production from improperly managed landfills is environmentally damaging.[295] It is estimated that improper management of landfills combined with increased waste production is putting Mozambique's greenhouse gas emissions on pace to double by 2030.[296] Improper land management as it relates to waste disposal additionally threatens groundwater resources.[297]

Tas and Belon (2014) identify a hierarchy of broadly defined strategies for waste management and mitigation.[298] In order of priority, they range from:

- Strategies for preventing the generation of excess waste
- Strategies for recycling materials and recovering gas produced by waste decomposition
- Strategies for reducing the damaging impact of waste on the environment

The report identifies two strategies that it argues are in line with the needs and means of Mozambique as a nation: the implementation

of environmentally safe landfills with the capability to recover methane for energy purposes; and the creation of facilities to deal with special types of waste.[299]
Waste management has generally been a high priority for the municipal government in Beira, which has been recognized for its good practices.[300] The city has additionally sought to collaborate with private sector partners to improve upon its service provision.[301] Cost estimates for the implementation of these strategies would be ascertained via professional consultation and are beyond the scope of this report.

Transportation

Mozambique is not a substantial emitter of greenhouse gases. Because the nation can approach development from a relatively clean slate, there are opportunities in the transportation sector to invest in technologies like alternative-fuel public transportation, without additional costs associated with converting a substantial amount infrastructure to support those investments.

Measures include:
- Public transportation services that run on alternative, clean fuels
- Urban planning to support non-vehicle transportation (bike paths and lanes, etc.)

According to the 2014 World Bank "Making Transport Climate Resilient" report, infrastructure should be constructed with consideration of the surrounding terrain and weather patterns and such that it requires minimal manipulation of the surrounding environment; constructing roads in lower-risk areas with minimal natural stress will increase both the life of the investment and recurring maintenance costs.[302]

3.1.3 Green Services

Green services is a term that can also encompass a variety of specific practices. Generally, it is considered an approach to business activities that leads to primary or secondary benefits for the environment, such as conservation of natural resources or reduction of environmental degradation.

Green services are sold to customers and include research, developed installation, and maintenance. Introduction of these types of green services can also significantly increase the resiliency of urban areas and their ability to overcome the impact of climate change shocks like droughts, flood, and erosion, and their secondary impacts on health, natural resource availability.

In this section, we will identify and evaluate potential for green services by sector. Many of the solutions identified in this section will also exhibit positive externalities across sectors.

Housing

In this sector, the focus will likely be on affordable, green building materials. Companies like http://conceptosplasticos.com have devised a way to use recycled inorganic materials like rubber and plastic to form interlocking blocks for the purpose of building low-cost housing (an unverified source estimates costs as low as USD 5,200).[303] Such an approach to low-income housing provision would cut down on construction costs, as well as cut down on the amount of inorganic waste being dumped in Beira's landfills.

Given that our previous low-cost estimate for a small, single family detached dwelling was USD 9,000, replacing concrete with recycled plastic wall material would represent savings in construction in the amount of USD 4 million for every 1,000 houses built.

Energy

We have already evaluated Mozambique's extensive natural energy endowments and their potential for exploitation. There are additionally numerous ways in which these resources might be applied in order to improve efficiency, or to reduce environmental impact of services.

One example is the potential for natural gas-powered vehicles in the transportation service sector. While these buses likely have higher initial cost, Mozambique's ability to potentially exploit an inexpensive and locally abundant energy source may lead to a significant reduction in operating costs over the long term.

Another area that should be explored is whether the application of alternative or decentralized approaches to energy provision to public utilities might reduce operating costs or improve service reliability. For example, floods often affect the flow of power to FIPAG's water provision facilities, which can cause the pipes to lose pressure and lead to service outages and water contamination.[304]

Water

There is a large informal industry surrounding the provision of water in areas without access to formal water supply. It is largely unregulated and exposed to the same types of climate and pollution risks as the formal sector.[305] As part of the World Bank's 2013 study "Private Sector Investment to Building Climate Change Resilience in Mozambique", a survey determined that these private providers were generally not investing in climate-resilience for their own businesses.[306]

Because there is likely room for development in this sector, the Government of Mozambique should explore whether it is possible moving forward to incentivize via policy the adoption of green and climate-resilient practices in the private sector. Currently, as with many other small businesses and enterprises in Mozambique, a lack of collateral, and high interest rates and minimum loan amounts are barriers to any potential investment efforts. Financial assistance might be made conditional upon the adoption of compliance with industry best-practice standards.

Areas of focus in this sector might include the establishment of minimum efficiency standards, and a closer examination of the impact that unregulated providers have on water resources.

Another area of opportunity in the water sector is the potential for establishment of Payment for Ecosystem Services (PES). Because the agriculture industry in Mozambique is fairly large, it may be cost-effective for the government to provide financial incentives for farmers to contribute to water conservation efforts. Areas to consider include the planting of relatively more water-efficient crops, techniques for improving soil water retention, and decreasing the use of chemical pollutants.

The 2010 government report "Mozambique Public Expenditure Review for the Water Sector," May 2010. noted that the water sector in Mozambique lacked an overarching strategic plan for investment and development. New policy initiatives should include a framework for development in the context of supporting environmental friendliness and climate change resilience.

Waste

Opportunities in this sector take two forms: business models and services that make use of recycled materials; and business models and services that simply mitigate the environmental impact of waste.

Opportunities in this sector include:

- Organic waste for compost/fertilizer
- Inorganic waste for building materials or similar
- Capture of landfill methane for energy purposes

A substantial portion of the solid waste generated in Beira is estimated to be organic. Private enterprise already exists to process organic waste into compost that can be used as fertilizer in agricultural production. A very small proportion of organic waste is currently collected for this purpose.[307] It is estimated that 65 percent of the solid waste generated in Beira is organic, and can be composted.

If this proportion is accurate, it may be that as much as 100,000 tons of organic waste are produced in Beira each year. With a waste-to-compost conversion rate of 31 percent (see

section 2), Beira has the potential to produce up to 31,000 tons of compost for agribusiness. At an estimated price of USD 130/ton[308], this has the potential to generate revenues in the area of USD 4 million per year. It would additionally be possible to convert solid organic waste into fuel briquettes, used as an alternative to raw organic materials or fuel oil.[309] While this an environmentally safe way to reuse organic waste, more exploration is necessary into the cost-effectiveness of organic briquettes relative to other sources of energy.

It is not clear the extent to which an effort is made to reuse recyclable, non-organic waste (wood, plastic, metal, etc.). This capability reportedly exists in Beira, though it is not clear how substantial it may be.[310] Such materials may be converted into useful household items for resale, which would assist in recovering costs, though this apparently not commonly done.[311]

Collection services and infrastructure are not currently sufficiently developed enough to allow for the efficient separation of different types of waste, and much recyclable material is consequently wasted.[312]

Furthermore, the lack of adequate waste collection service coverage often leads to people disposing of waste in environmentally unfriendly ways (e.g. burning, burying, dumping into waterways, etc.). Some municipalities have sought to alleviate coverage gaps (often the result of difficult or expansive geography) by paying small private contractors to transport waste from unserved areas to collection points that are then serviced by the municipal authority.[314]

Lower-cost strategies for mitigating solid-waste related issues might include education regarding proper sorting of recyclables (which might include or necessitate the creation of municipal or private-sector recyclable materials authority), as well as education on proper composting techniques at the household level.

Flood Control

Initiatives in this sector include the development of a service sector that addresses the maintenance needs of Beira's natural coastal defense and drainage infrastructure. As part of the World Bank Cities and Climate Change Program, Beira has solicited nearly USD 62 million in financing for drainage and coastal defense infrastructure improvements. The annual maintenance costs for the drainage infrastructure are estimated at USD 150,000 (see section 2.5.7).

Agriculture

Agriculture accounts for 24% of GDP, but provides income for between 70-80 percent of Mozambique's population.[315,316] Given that land is generally suitable for agriculture, the lack of investment in this sector seems to be neglecting a large amount of untapped economic potential. One of the problems in this sector is the prevalence of small or informal commercial agricultural enterprises, and the prevalence of household-level participation in agricultural activity. Many of these people do not have the steady/formal income stream or credit/financial history to successfully obtain a loan from a private, formal lender for the purposes of investing in business development. Although the agricultural sector is a prime target for investment, the general economic profile of sector participants means that such a development initiative would likely require a strong and sustained commitment from the state, as the risk associated with lending is probably too high at present to attract commercial lending institutions.[317]

Growth in this sector should be consistent with the national policy principles listed earlier in this chapter, with an emphasis being on environmental sustainability and pro-poor growth.

3.2 Sources and Status of Financing

Currently there are few active sources of private sector finance focused on green urban solutions. However, donors have established a robust portfolio of investment using traditional grant and loan mechanisms.

The government in Mozambique has also been very active in the past decade, albeit with more constrained financial resources than those available to international donors. Multilateral development banks and bilateral grant programs provided nearly 5 percent of the national budget of the government in 2016. The majority of the environmental expenditures by the public sector that would be considered "green" are facilitated by MICOA using traditional cash expenditures with no debt financing.

The municipal governments have a particularly limited capacity to make significant capital investments in climate change adaptation measures, and therefore they focus on operations. This is for two reasons: total revenues are typically small and completely accounted for by routine municipal operations; and debt financing is extremely restricted by the national government to prevent solvency crises at the city level. However, even with this limited involvement, many opportunities for climate change adaptation exist, but municipalities are either not aware of these strategies, or do not know how to properly conduct a cost-benefit analysis of operations focused climate change adaptations, and therefore don't make such changes.

Specific to Beira, the largest investments have been in the sanitation and flood control sector with assistance from the EU, World Bank, KFW and GIZ. EU funding was applied to the combined sewer main lines; the World Bank contributed funding to the flood channel, outfall and gate; KFW is supporting the expansion of combined sewer main lines; and GIZ is working with communities to develop tertiary drainage systems.

There has also been smaller investment in waste to energy by UN-HABITAT and decentralization of sanitation (e.g. latrines) by the Dutch NGO FUSP.

In the water sector, the Vitens Evides International is also working to increase the treatment capacity from the river, and to reduce non-revenue water. These efforts will minimize the high requirements and demand for abstraction from the river, and thereby decrease the cities vulnerability to drops in river flows (see Appendix A).

Independent of previous investment projects, a detailed pipeline has been developed for future development projects. The majority of these projects were identified in response to financing needs as part of the 2035 Beira Master Plan, but no sources of finance are committed (see Appendix B).

No figures are available concerning the total contribution of the Mozambican government to climate change related actions. Warner et. al (2013) concluded that total expenditures on environmental action (including climate change-related expenditures) equaled about MZN 3.5 billion (around USD 125 million) per year between 2007 and 2010, which in 2010 was roughly 4 percent of the state budget and 1 percent of GDP. For the same period, annual economic losses due to environmental degradation and inefficient use of resources was estimated at MZN 24 billion (9 percent of GDP).[318]

Mozambique receives international climate funding from the Global Climate Change Alliance (GCCA), Clean Development Mechanism (CDM), and as one of the pilot countries of the Pilot Program on Climate Resilience (PPCR)/ World Bank Climate Investment Funds. Among all Sub-Sahara African countries, Mozambique was third (in 2014) in terms of the climate finance that had been approved (ca. USD 130 million; South Africa was first with as much as USD 500 million).[319]

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Chapter 4

Financing Instruments

The Financial System

In 2013, Mozambique's financial system consists of 18 commercial banks (5 of which have microfinance operations); 8 registered microbanks; 10 saving and credit organizations; 7 credit unions; one investment company; one risk capital company; and 166 micro credit operators.[320]

The banking sector in Mozambique is highly concentrated; in 2014, Mozambique's four largest financial institutions controlled 85 percent of the sector's total assets.[321] In 2015, the five largest financial institutions accounted for 87 percent of the sector's total assets.[322]

In Mozambique, all standard financing instruments exist. Debt financing is facilitated by international banks, some national banks and micro finance institutions. The government can additionally borrow from multi-lateral development banks in addition to commercial banks, or they can solicit investment from third parties to develop infrastructure. There is a local capital market (the Maputo Stock Exchange), and foreign investors are active in Mozambique. The primary issue is not the availability of diverse financing instruments, but that on the demand side, there are few entities that can present a sufficient financial history, and projects that are both bankable and properly developed enough that they can successfully negotiate financing. Consequently, financial markets in Mozambique are generally underdeveloped, and have been slow to meet demand for financing.

Policy and strategy relevant to the development of Mozambique's financial sector includes the Financial Sector Development Strategy (2013-2022), which addresses national macroeconomic policy, social spending, financial sector regulation, public-private partnership regulation, real estate markets, and the expansion of banking, insurance, and credit services; and the Foreign Exchange Law (2011) which eliminated any exchange restrictions on payments and transfers, stipulated that 50 percent of revenues from exports must be converted to local currency, and required the repatriation of all foreign earnings.[324]

Challenges in Project Finance

In Beira, as in many of Mozambique's municipalities, the majority of infrastructure is of relatively poor quality and was financed through direct budget expenditures due to restrictions on municipal debt financing (largely due to concerns about the public debt burden and government solvency). In comparison, financial flows from leveraged investments by the government or households (e.g. tied to loans) are negligible. To illustrate, in 2012 total credit issued to the economy nationwide was

Table 4.1 Loans by Sector, Proportion of Total (Nationally)[327]

Loans per sector (%)	2009	2010	2011
Agriculture	5.80%	6.70%	6.50%
Industry	11.20%	9.60%	9.00%
Tourism	2.70%	2.70%	2.10%
Construction and public works	6.90%	7.10%	7.70%
Commerce	19.80%	19.90%	19.20%
Transport and Communication	12.80%	12.60%	10.20%
Individuals	19.20%	19.00%	25.10%
Housing	2.70%	2.80%	2.40%
Other sectors	18.80%	19.50%	17.80%

Table 4.2 National Distribution of GDP by Broad Sector (percent of total)[329]

Industry	Year					
	2010	2011	2012	2013	2014	2015
Agriculture	30%	29%	28%	27%	25%	25%
Industry	8%	8%	9%	9%	11%	12%
Manufacturing	11%	11%	10%	10%	10%	10%
Services	52%	52%	53%	55%	54%	53%

*Data sourced from World Bank, 2016 via cited report

only 27.7 percent of GDP.[325] This increased to 31.1 percent of GDP in 2013 and was projected to grow to 34.4 percent of GDP by the end of 2014.[326] The proportion of loans by sector in the period 2009-2011 is summarized below:

In 2011, 90.5 percent of loan volume in the Mozambican economy was provided to the private sector. Of the total of credit extended in the economy, 77.8 percent was issued in local currency. The total volume of credit to the private sector in 2011 was roughly USD 3 billion. This would place the total volume of credit issued to the public sector at this time at roughly USD 310 million; at this time however, the proportion of credit in the economy issued to the public sector was growing at a rate of 56 percent annually.A major impediment to borrowing for the purpose of infrastructure investment is the difficulty of financing in the local currency. Mozambican companies have occasionally sought to generate funds locally via equity finance. Although there has been investor interest, this financing route has been of limited utility: the total market capitalization of the Maputo Stock Exchange in 2013 was barely greater than USD 1.1 billion.[330] Additionally, the 2015 DFID report "Mobilising Finance for Infrastructure" notes that interest rates charged on commercial loans are often prohibitively high, and that the maximum tenor on commercial loans is typically much shorter than is realistic for the investment required to fund a significant infrastructure project.[331] The reliance of the national government on natural resource sectors, and a tax base consisting largely of poor households and small/medium enterprises limits borrowing capacity, especially when commodities are down.

Despite progress over the course of the recent past in bringing down interest rates, Mozambique's prime lending rate remains high at just over 15%, which is largely a product of the country's inability to rein in inflation year to year.[332,333,334]
Financing in international currency would solve both of the above issues, but comes with significant risk for borrowers due to exchange rate volatility; the MZN/USD exchange rate has fluctuated greatly over the course of the past several years, soaring from around 30 MZN/USD just several years ago, to over 70 MZN/USD in late 2016, before falling more recently to 60 MZN/USD.[335]

Export-facing sectors may more reasonably be able to borrow in foreign currency;[336] however, it is not clear which industries might generate sufficiently large amounts of foreign exchange in a stable foreign currency. The report cites Mozambique's energy sector, in which a substantial portion of production is exported to regional buyers.[337]

Key non-financial constraints include a national government that, while receptive to new development opportunities, is not particularly adept at actively soliciting and managing proposals and partnerships.[338]

Challenges in Household & SME Finance

In 2009, only 11.8 percent of Mozambique's adult population made use of banking products and services.[339] At this time, two commercial banks had as clients 79.4 percent of current account holders. Despite this, microfinance

institutions accounted for 62.5 percent of all loans with terms of one year or less, and 70.5 percent of all agricultural loans.[340]

Additionally, a survey conducted as part of the 2009 FinScope "Access to Finance" report found that saving activity was rarely aspirational, or intended facilitate upward mobility; rather, responses often indicated that saving was in anticipation of emergencies or financial hardship.[341]

This lack pervasive lack of financial history and resources particularly impacts households and private businesses who in-lieu of financial history must provide large collateral commitments and accept high interest rates to meet the risk requirements of banks, which frequently makes debt financing economically non-viable.

Additionally, many critical sectors in Mozambique (in particular water, sanitation, and agriculture) have generated substantial informal economies in the presence of large gaps in provision.

Many of the these informal and SME producers/ providers do not meet the financial/credit requirements necessary to receive loans. As a consequence, Mozambique's private and commercial lenders are not particularly exposed to climate change related risk, and therefore do not face much economic incentive to invest in new, resilient development.[342]

Soliciting investment in climate risk mitigation via mandatory insurance appears to be a relatively unexplored avenue. Insurance of any type is generally rare in Mozambique; a 2012 survey indicates that only 11.5 percent of rural adults and 31 percent of urban adults were familiar with the concept.[343] Based on response data, only 2.3 percent of the adult population had purchased formal insurance of some type.[340] A 2013 World Bank report on private sector finance in Mozambique estimated that institutional investors, including insurance companies, only controlled assets equal to about 1 percent of GDP.[345]

4.1 Key Constraints in the Housing Sector

The Reall Beira housing market study collected data that led the surveyors to estimate that 44 percent of people in Beira live in rental housing, that 35 percent of people own their own home, and that 17 percent live in a parent's home. They further estimate that 50 percent of these homeowners do not have complete legal documentation of ownership.

These results are likely methodologically skewed, as respondents were pre-selected based on income profile monthly range of MZN 4000-14,500 for an individual, a range that covers upper and upper-middle class households.

The survey does not indicate an average rent, but indicates that most respondents are paying less than USD 91 (MZN 5000) per month, not including utilities. This is still substantially beyond the means of most low-income households; the most common response for willingness to pay in this survey was between MZN 1000-2000 (USD 18-36 per month).

The 2013 CAHF Housing Finance in Africa report states that most of Mozambique's commercial banks offer some type of mortgage product, though they are not pervasive; the report estimated that outstanding mortgage debt amounted to roughly 0.6 percent of GDP, and only 2.24 percent of all loans.[346,347] The report estimates that the proportion of non-performing mortgage loans is on par with prevailing non-performing rates in the credit market as a whole.[348] The rate of non-performing loans of all types was as high as 17 percent in 2003, but has dropped substantially to 1.9 percent in 2010, and 3.5 percent in 2012. It is important to note that lending restrictions to mitigate credit risk to lenders is likely responsible for much of this decrease in default rates.

Banco Unico and BCI both offer leasing and rent-to-buy housing products, though it is not clear that such products are common, as the

report states that the offerings are exclusive to Maputo.[349] Constraints in this area are likely to include the dearth of speculative lower-income housing construction previously mentioned. The financial particulars of a typical rent-to-buy product are not elaborated, but the 2014 CAHF Housing Finance in Africa cites one example in which the monthly lease is USD 317 per month, which would exceed the means of all but a portion of the top quintile of earners in Mozambique.[350]

The Fundo de o Fomento da Habitação (FFH, or Housing Promotion Fund) is a national government institution that was in its original iteration tasked with both constructing and improving low-income housing.[351] It would then resell these homes via highly subsidized loans and use the proceeds to operate loan assistance programs.[352] As a result of these programs, the government has long since divested from the vast majority of the state-owned housing that was nationalized in the wake of colonial independence.[353]

While the price points quoted in the report resultant from these early initiatives appeared to be much more attainable for middle income households, the programs themselves were extremely limited in scope and the heavy subsidization made their long-term fiscal sustainability untenable.[354] Since 2009, FFH has sought to limit its mission to housing finance. [355]

It is not clear whether FFH still manages any property assets; during the course of research for this report, it largely seemed as if most housing development undertaken by FFH was done in partnership with private developers, and was targeted toward high-income households and priced only marginally below market rate. For example, Reall notes that FFH has been implementing a social housing program for low-income families; a two bedroom unit costs MZN 1.8 million (roughly USD 33,000), a three bedroom unit costs MZN 2.4 million (roughly USD 44,000), and a four bedroom unit costs MZN 3.4 million (roughly USD 62,000).[356]

The general pace of housing development is further inhibited by a persistent shortage of land that has been appropriately serviced and zoned for the purpose of housing construction.[357] A social consequence of this shortage has been a tendency for higher-income households to bid the price of available plots beyond the means of lower-income households.[358]

NGO support for housing development is extremely limited and occurs mostly in the context of disaster relief; the report identifies Habitat for Humanity as the singular exception.[359] At the time of the report (2008) Habitat for Humanity had established a development-microcredit partnership with Banco Oportinidade for the purpose of constructing low-income housing.[360]
Policies and strategies relevant to general financial sector development, and housing finance and development include:[361]

- The Financial Sector Development Strategy (2013-2022), which also includes an effort to bolster the market for housing-related finance (both construction and purchase).
- The 2012 Economic and Social Plan.
- Slum Upgrading Strategy
- Land Law of 1997, which asserts that all land remains the property of the state, while at the same time granting broad and accommodating land-use rights for citizens making good-faith use of land resources.[362]

Challenges in Project Finance

It should be noted that roughly 84 percent of Mozambican construction firms are SMEs. Speculative development of housing is often constrained by the facts that developers themselves often do not have sufficient capital in reserve to self-finance, and that banks have been slow to explore opportunities in this area [363] In 2012, only 9 percent of credit was issued to construction and public-sector development projects[364]; this amount increased to 10.2 percent in 2014.[365]

It is currently unclear to what degree loan products from microfinance Institutions are available and applied to housing-related expenditure. However, the 2013 CAHF Housing Finance in Africa report cites a survey that identified five microfinance institutions that offer housing-specific loan products, and estimates the total size of all outstanding debt in the local microfinance market at USD 74.1 million.[366]

Because laws are currently such that land itself cannot be used as loan collateral (the government ultimately retains discretionary authority over land usage, therefore, for the purposes of obtaining a loan, land is not recognized by banks as being an asset of the borrower), and that a house (the structure itself) cannot be mortgaged until it is at least 80% complete (at which point it is determined to be an asset of value in the case of repossession), it is typically that case that other assets must be used as collateral during the early development period.[367] Interest rates for developers can run as high as 23 percent.[368]

Developers also face obstacles in the form of administrative red tape, having to navigate a multi-institution network of regulators and permit offices in order to proceed with construction.[369] The process associated with registering property is estimated to take roughly 6 weeks and the fees associated with the application can cost between 6.9-8.7 percent of property value.[370, 371] This, in addition to the dearth of specialized labor and large-scale construction initiatives (i.e. projects that generate economies of scale), negatively impacts productivity. In total, construction costs in Mozambique are estimated to be roughly 30 percent higher compared to those in neighboring South Africa.[372]

Challenges in Household Finance

Conditions of borrowing in Mozambique are such that few people at all have the financial resources necessary to be eligible for mortgages (income, credit history, collateral, etc.). Annual surveys of Mozambique's housing market describe the typical mortgage product having an annual equivalent rate of up to 19 percent, with a 20-25 year term.[373,374] It further states that banks expect a loan-to-value ratio of around 80 percent (though this can be as low as 70 percent. Although we don't know the typical size of a mortgage loan in Mozambique, there is typically a minimum loan amount of USD 8,300 to 10,000 which implies that a consumer would require savings in excess of USD 2,000 to purchase a home costing at least USD 10,000. [375,376,377] In 2015 the mortgage loan to GDP ratio was just 0.6%, a total volume of USD 88.8 million.[378]

Purchasing power (income) relative to the cost of housing is the key constraint in this area. As the 2008 "Access to Housing Finance – Exploring the Issues" report notes, an estimated 85% of households at that time earned between USD 0 and USD 150 per month.[379] In Maputo, even renting a garage in which to can cost as much as USD 166 per month.[380] Consequently, many households are forced to self-construct on an incremental basis over their lifetimes.

The most recent estimates found of the number Mozambicans of working age with an account at a formal financial institution range from 10-40 percent.[381,382] Additionally, interest rates tend to be high, often in the range of 16 to 22.5 percent, to compensate for a combination of credit and inflation risk. A further constraint to both lending/borrowing and generally to the purchase/sale of property is that many people lack formal legal documentation of ownership. Short-term loans to assist with construction or home improvement are also available. These loans are usually of short term (3 to 5 years), and are unsecured and thus carry interest rates as high as 22.5 percent.[383] Consequently, low-income residents generally must construct their own homes using cash savings to purchase the cheapest and most readily available materials.

4.1.1 Assessment of Financing Instruments in the Formal Housing

Formal housing in Mozambique is considered

to be a dwelling unit that was constructed by a third party, such as the government or a private contractor, that resides on the property or land that has a DUAT from the national government or title from the municipal government. If the property is rented, it must have a signed contract between the two parties that is notarized by the national or local government.

Typically, the owner of formal housing has either paid cash or taken out a loan for the construction of the dwelling, or they have purchased a built property with cash or by taking out a mortgage.

In Mozambique, less than 1 percent individuals have a mortgage while 10 percent own their home. This means that 9 percent either paid for their property with cash savings or it was inherited or given to them by family or the government.

In order for an individual in Mozambique to take out a mortgage or receive a loan from the bank, they must have documented rights to the land as a lessee, have a salaried employment that is paid to a bank account, and have adequate savings to pay for their equity contribution to the project.

Salaried employment is a job that includes long-term contracts with a guaranteed minimum some of remuneration that is paid on a weekly or monthly. Borrowers can alternatively use existing property as collateral for a loan. However, a new building cannot be considered as collateral for a loan until the unit is 80 percent constructed; the property in a partially-constructed state otherwise has little value.
Since most individuals in Mozambique do not have a bank account, salaried employment, or documented ownership of land, they must rely on either paying for the construction or purchase of their dwelling from their own savings, or they must rent. The lowest-cost dwelling considered in this report costs more than USD 5000 to construct and the average individual in the city makes less than USD 1000 a year; with regards to renting, property available for rent in the city can cost several hundred USD per month, and demand far outstrips supply.

In support of the construction of new dwelling units, the government and private land developers have a few additional sources of finance that individuals cannot access. Governments can use tax revenues fund the construction, sale or renting of dwelling units. Governments can also take loans from development banks or commercial banks, with interest rates being dependent on their perceived credit risk. For loans from development banks, these interest rates can be as low as 0 percent and from commercial banks range from 5 to 20 percent. The terms for these loans can be between 10 and 30 years. Governments can also obtain grants from international donors, or float bonds.
The national government in Mozambique established the Fund for Housing Promotion (FFH) in order to increase the construction of dwelling units using tax revenues and loans. They have invested over USD 100 million using a combination of these financial sources.

Similar to governments, private land developers can receive loans from commercial banks with lower interest rates and longer-term periods. They can also raise capital from equity funds or wealthy individuals. In Mozambique, there are a number of companies that are constructing dwelling units using a combination of these financial sources. See section 2.5.1 for examples of these projects.

Developers in the formal housing market tend to focus almost exclusively on developing housing affordable for the upper-middle and upper-class income brackets, because of the greater potential profit margins and lower market risk.

Key Characteristics of Formal Housing Market Participants

- Salaried
- Income likely in the top quintile of earners
- Legally Documented ownership of land

- Savings, or other assets to be used as collateral

Key Characteristics of Formal Housing Market Transactions

- Capacity to finance purchase via formal loan or mortgage
- Relatively more favorable loan terms (though interest rates in Mozambique are generally high)
- Ability to buy new or modern quality house on serviced plot

4.1.2 Financial Sources for Formal Housing

Mortgage

As previously stated, the typical mortgage product has an annual equivalent rate of up to 19 percent, with a 20-25 year term[384,385] Banks expect a loan-to-value ratio of around 80 percent (though this can be as low as 70 percent) and a minimum loan amount of USD 8,300 to USD 9,500[386,387,388] In 2008, housing loans were 3.8 percent of bank credit.[389]

Commercial Loan

Speculative development of housing is often constrained by the facts that developers themselves often do not have sufficient capital in reserve to self-finance, and that banks have been slow to explore opportunities in this area.[390] In 2012, only 9 percent of credit was issued to construction and public-sector development projects;[391] this amount increased to 10.2 percent in 2014.[392]

Self-finance/Construction Loan

Short term loans to assist with construction or home improvement are usually of short term (3 to 5 years) and are unsecured and thus carry interest rates as high as 22.5 percent.[393] Consequently, low-income residents generally must construct their own homes using cash savings to purchase the cheapest and most readily available materials. Very few Mozambicans have substantial savings, and thus must undertake home improvements on an incremental basis.

Rent

Allen and Johnsen (2008) estimated that 85 percent of households at that time earned between USD 0 and USD 150 per month.[394] In Maputo, even renting a garage in which to live can cost as much as USD 166 per month.[395] In Maputo's Central District, rents for homes can range from USD 1,500 to USD 10,000 per month.[396] While Beira, is a smaller metropolitan area, it is reasonable to expect similar affordability issues.

Third party/Foreign Direct Investment

Mozambique has successfully negotiated contracts with foreign developers and sovereign development agencies for the construction of housing. Section 2.5.1 details nearly USD 6 billion in contracts for the development of roughly 70,000 housing units in the period spanning 2011-2014. The consistency of such efforts is not clear, and despite their success, they are relatively small when compared to the overall demand gap.

4.1.3 Assessment of Financial Instruments for Informal Housing

Informal housing in Mozambique is considered to be a dwelling unit that was constructed by the occupant himself, either incrementally or all at once, using their own funds. Informal housing is also considered to be a dwelling unit that is constructed on land without a DUAT (formal lease agreement with the government) or legal title properly documenting their land ownership or is a building inherited or given to the occupant without proper documentation of ownership and transfer. A dwelling unit can also be considered informal if there is no formal contract that is signed by both parties and notarized by a national or local government. In Mozambique, most individuals live in informal housing. A recent survey established that 90

percent of homeowners do not have proper documentation, as well as greater than 50 percent of renters.

Sources of finance can include microloans and community loans. Microloans are issue formally via microfinance institutions, and are usually for small amounts, are unsecured, and therefore have short tenors and relatively high interest rates. Community loans are issued by informal institutions such a savings groups, or a lent between friends and family members.

A 2009 FinScope survey of Mozambique's financial sector determined that only 3.4 percent of urban adults had received a loan through a bank or other formal financial institution, while 6.1 percent of urban adults had received a loan through family and friends, or by some other informal means.[397] Loan-equity ratios for micro finance loans or community loans are typically such that borrowers must have 75 percent of the loan amount in savings. The equity contribution requirement for a home loan is typically 50 to 60 percent of the dwelling unit's value.

Since most individuals in Mozambique do not have a bank account (the 2009 FinScope report estimates that only about 12 percent of Mozambicans were formally banked), salaried employment, or documented ownership of land, they must rely on either paying for the construction or purchase of their dwelling from their own savings, or they must rent.

In Mozambique, subsidies are not available from the government for the construction of new housing, purchase of existing housing, or rental of housing. Neither are subsidies (grants or tax credits) available for private land. The following characteristics are typical of informal housing markets:

Key Characteristics of Market Participants in Informal Housing

- No financial history
- Low income, informal and non-salaried employment
- No assets that can be used collateral
- Limited or no legal documentation land ownership

Key Characteristics of Transactions in Informal Housing Markets

- Loans, where available are for small amounts, unsecured, and have short tenor and high interest rates
- Home improvements are typically financed via informal loans, or paid for with cash savings
- Homes are built incrementally, and often construction is of low quality

4.1.4 Financial Flows and Sources for Informal Housing

Microfinance

Short-term loans to assist with construction or home improvement are usually of short term (3 to 5 years), and are unsecured and thus carry interest rates as high as 22.5 percent.[398] Consequently, low-income residents generally must construct their own homes using cash savings to purchase the cheapest and most readily available materials. A 2009 FinScope survey of Mozambique's financial sector determined that only 3.4 percent of urban adults had received a loan through a bank or other formal financial institution.[399]

Community Lending

A 2009 FinScope survey of Mozambique's financial sector determined that only while 6.1 percent of urban adults had received a loan through family and friends, or by some other informal means.[400]

Self-finance

A lack of financial resources and proper legal documentation mean that many Mozambicans must construct their homes on an incremental basis using cash savings. It is estimated that over the course of a lifetime, the average household spends USD 15,000 on home improvements and repairs.

Rent

It is not clear what proportion of Mozambicans rent. The 2008 "Access to Housing Finance – Exploring the Issues" report estimated that 85 percent of households at that time earned between USD 0 and USD 150 per month.[401] In Maputo, even renting a garage in which to can cost as much as USD 166 per month.[402] In Maputo's Central District, rents for homes can range from USD 1,500 to USD 10,000 per month.[403] Although incomes have improved substantially since 2008, the household expenditure data cited in earlier sections of this report would still indicate that these rental prices are out of reach for most households, and no evidence of government rent subsidies/controls was found during the course of research for this report.

Third party

As noted elsewhere in this report, the vast majority of housing development in Mozambique is targeted towards upper- and upper middle-income households. There is a major demand gap in Mozambique for affordable, low-income housing. Government, commercial lending institutions and large developers are likely the only entities in Mozambique with the resources to take on the risk and low profit margins associated with low-income housing. Construction of such housing may even require direct subsidization.

Public Subsidy/Tax Expenditure

As previously noted, it does not appear that the Government of Mozambique makes use of such policy instruments to assist in the construction or acquisition of low-income housing. As noted previously in this report, the national government of Mozambique has already liquidated most of its housing assets. Furthermore, the national government is made solvent only by regular and substantial foreign assistance, and it is not clear what funding might be available for such programs.

4.2 Assessment of Financing Instruments in Transport

Grant/Subsidy

A 2008 USAID Urban Transport Policy Proposal notes that public transport service provider TPM (Maputo) is not solvent without government subsidization of operating costs and the purchase of new buses, in all about 40 percent of its total expenditure.[404] Replicating such an arrangement for all of Mozambique's major cities would represent a major direct expenditure and is likely not a feasible option; the sector itself must be able to recover costs. With regards to private sector service providers, the government offers a fuel tax rebate of 30 percent.[405] This subsidy is largely unused because it would allow business owners and the government to use fuel invoices to better estimate the revenue earned by vehicle operators.[406] The major impediment to solvency in this sector is the inability to charge cost-reflective tariffs in the face of substandard services.

Direct budget

Maputo provides an example of a dedicated economic instrument in the public transportation sector; 5 percent of fuel tax is transferred to a fund meant to support fuel subsidies for private operators, as well as costs incurred by the public operator.[407] Otherwise, the operating budget of the public transportation authority is likely made up of a combination of general revenues and federal government grants.

Debt Financing/Bond

Public debt in Mozambique is heavily regulated; this is to actively prevent solvency issues from arising in municipalities with very little fiscal space. The Government of Mozambique has received loans for the development/maintenance of the transportation sector through the World Bank (See Appendix A).

Third party and lease

Toll roads have been successfully implemented in Mozambique; however, the affordability of tolls for regular commuters has been a point of contention between operators and drivers. Otherwise, concessions for infrastructure investment and operation has typically focused on areas of the transportation sector that are specifically critical to commerce (e.g. ports and railways).

In the area of transportation services, mass transit is often provided by private providers operating small taxis and buses (chapas). This sector is taxed, though tax evasion is common. Private transportation providers are largely unregulated and inefficient. However, these services are well patronized, indicating that demand is generally high despite high prices and poor service quality. A higher quality product would be well received by the public.

Microfinance (transport services)

It is not clear whether Mozambique's microfinance institutions typically offer loan products for the purpose of financing the purchase of cars and buses.

4.3 Assessment of Financing Instruments in Energy and Power

Direct budget

EDM tariffs on electricity consumption are nationally unified, but progressively tiered to accommodate different household consumption levels; in this sense, they are pro-poor.[408] However, an enduring problem that impacts the financial sustainability of EDM is the fact that tariffs are not sufficient to cover operating costs.[409]

Grant/Subsidy

EDM has used a combination of grants and loans to finance an aggressive rural electrification program, which added over 260,000 connections from 2008-2010.[410] In 2008, USD 80 million was spent on expansion, of which 75 percent came from the Swedish International Development Agency, the Norwegian Agency for Development Cooperation, the Danish International Development Agency, the World Bank, and the African Development Bank.[411]

Around this same period, EDM additionally implemented an initiative to add connections to low-income urban households around Maputo with the assistance of the Development Bank of South Africa.[412]

Public Debt/Bond

Mozambique has successfully received loans for development in the energy sector from the International Finance Corporation (see Appendix A). EDM has consistently pursued expansion of the electric grid using a combination of loans, grants and direct expenditures.

Third party and lease

There is significant degree of privatization in the energy production sector, with major local and foreign developers active in the hydropower, coal, and natural gas sectors (see section 2.5.3). This is one of Mozambique's more lucrative sectors, because of the strong foreign markets with which Mozambique has established power-export relationships.

Self-finance/Microfinance (household)

It is not clear whether microfinance institutions in Mozambique offer products to finance the purchase of energy-efficient appliances, or decentralized, household power production methods (such as solar panels). Impediments to household-level borrowing are detailed at length elsewhere in this report.

4.4 Assessment of Financing Instruments in Water, Sanitation & Flood Management

Direct budget

In Beira, municipal water is paid for via a tariff on water consumption; sanitation services are paid for via a 15 percent surcharge on water consumption. It is unclear how solid waste management services are financed; this report found no evidence of dedicated policy instruments, and so it is likely that general revenues make up some proportion of the solid waste management budget.

In Maputo, municipal solid waste management services are financed via a tariff on electricity consumption; service premiums on excessive and non-residential waste producer; fees at disposal sites; and fines on illegal dumping. It is not clear how these services are funded in Beira, though it is likely via general revenues.

Grant

Beira's water, sanitation, and flood management sectors are the most heavily targeted sectors by multilateral and sovereign development institutions and donors. The World Bank Cities and Climate Change Project is one of the largest contributors to multi-sector development in this area. See Appendix A for a complete list of initiatives across these sectors.

Public debt/Bond

Beira's water, sanitation, and flood management sectors are the most heavily targeted sectors by multilateral and sovereign development institutions and donors. Development is financed by a collection of grants and loans.

Third party and lease

Privatization of these sectors is permissible by law; however, private operators in the waste management and water sectors tend to be small and informal. In Beira, municipal utility providers provide the bulk of services in these sectors. Third party consultants and developers are often contracted to assist in the development of these sectors. Dutch national water company Vitens Evides International recently partnered with the City of Beira for the purpose of rehabilitating the city's drinking water infrastructure.

Microfinance/ Self-finance (household, SME)

It is unclear if any loan products are available to Mozambican households for home improvement projects, which might include flood-proofing, rainwater treatment systems, or household waste management solutions such as latrines or septic systems.

It has been noted that small service providers in the water and sanitation sectors exist largely to meet demand not addressed by municipal utility providers. Bolstering the capability of credit-worthy providers in these sectors to grow their businesses is an alternative approach to closing the demand gap.

Other opportunities for micro investment in these areas involves assisting with the water management capabilities of small agricultural businesses. All the previously detailed impediments to household and small/medium enterprise borrowing apply in these cases; small and informal businesses in Mozambique often lack the financial resources and formal development (capabilities in data/records management, financial/asset management, and regulatory compliance) that would make a formal lender comfortable considering the issuance of a loan.

4.5 International Finance

Appendix A provides a sample of the volume of financial flows from international finance institutions, such as the World Bank, African Development Bank and KFW, and bilateral donors, such as GIZ, SDC and others. Aggregate financial flows for the past several years are summarized below in Table 4.3.

It is important to note that actual committed funding is likely higher; the above table provides aggregated data from readily available statistics. Please see Appendix E for a breakdown of donor financing by sector.

4.6 Assessing City Level Financing Challenges

The 2015 DFID "Mobilising Finance for Infrastructure" report assessed that investor interest is sufficiently present to support new development, and that the primary constraint on new development seemed to be a lack of a sustained and coherent effort on the part of government to support the emergence of a private infrastructure market.[414] The report further assessed that the government was not equipped to properly field and support proposals for new investment and public-private partnerships.[415] These barriers generally contribute to a dearth of sufficiently well-formed investment opportunities.

The fact that the ultimate success of investments in multiple specific sectors will be contingent upon the city successfully implementing a holistic approach to development presents major challenges in terms of strategy, logistics and financing. For example, investment in transportation and housing stock must be considered in conjunction with climate change-related storm- and floodwater-related vulnerability; similarly, expansion of basic municipal services should be approached at the strategic level as part of a general housing and urban development plan to avoid a costly and haphazard extension of water, energy, and sewer grids.

4.6.1 Macro Level

General challenges that have bearing on the ability of households, businesses, and

Table 4.3 Estimated Aggregate Financial Flows to Mozambique, International Donor Sources (USD Millions)[413]

Funding Source	Year	2008	2009	2010	2011	2012	2013	2014	2015
OECD	Other Grants	1476.38	1426.58	1470.25	1503.97	1529.79	1569.13	1438.75	1239.43
	Gross Loans	344.88	469.82	375.66	391.47	423.65	573.49	549.53	692.00
	Net Debt Relief Grants	0.03	0.13	0.49	0.29	0.00	24.51	5.43	7.99
	OECD Total	**1821.29**	**1896.53**	**1846.40**	**1895.73**	**1953.44**	**2167.13**	**1993.71**	**1939.42**
World Bank Group and Trust Funds	IFC	-	27.50	41.50	1.36	39.01	39.65	41.34	30.40
	IDA	-	159.60	260.40	413.00	377.00	337.00	409.40	225.00
	IBRD	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MIGA	-	0.00	0.00	11.56	0.00	0.00	0.00	0.00
	TFs	-	91.07	28.60	107.19	19.90	17.52	78.16	6.32
	WBG Total	**-**	**278.17**	**330.50**	**533.11**	**435.91**	**394.17**	**528.90**	**261.72**
African Development Bank	AfDB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
	ADF	70.62	78.08	76.54	57.77	75.28	71.47	82.46	-
	NTF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
	AfDB Total	70.62	78.08	76.54	57.77	75.28	71.47	82.46	-
IsDB & WBG	IsDB	16.19	10.71	0.00	12.55	24.09	18.11	-	-
	IsDB Total	16.19	10.71	0.00	12.55	24.09	18.11	-	-
	Total Funding	**1908.10**	**2263.49**	**2253.44**	**2499.16**	**2488.72**	**2650.88**	**2605.07**	**2201.14**

Government institutions to finance development via debt include:

- Households and small businesses do not have adequate financial history, savings, or assets for obtaining a loan.[416]
- Municipal department budgets are heavily dependent upon fiscal transfers from general municipal revenues, and from the federal government. These are not reliable sources of funding.
- Tax revenues are mostly collected by the national government, but expenditures for most public services are made by local government
- Royalties from port revenues and natural resources shipped through Beira are also collected by national government, with little being redistributed locally.
- Banks are tentative about expanding credit/loan product offerings; demand for affordable credit is high, while supply is low.

4.6.2 Sectoral

Housing

Challenges in the housing sector include:

- Formal home ownership is too costly. Additionally, a lack of supply of serviced plots has contributed to price inflation by inducing competition between upper- and lower-income households.
- Construction costs are high. This is a combination of high material costs, labor inefficiency, and an inability to take advantage of economies of scale. Construction costs in Mozambique are estimated to be roughly 30 percent higher than in South Africa.[416]
- Lack of quality affordable materials; For example, in the past, the government has argued with cement sellers over fluctuations in the market price of bags of cement; in 2012, prices increased by over 60 percent in response to increases in transportation costs even though the government attempted to keep prices low by capping seller profit margins.[417] A 2014 Centre for Affordable Housing Finance report estimated that Mozambique imported up to 90% of building materials, leading to frequent price fluctuations.[418]
- Development permitting fees estimated to be a substantial portion of the cost of development (as high as 8 percent).[419] Administrative red tape is often an impediment to development progress.
- Land use density is too low. Urban sprawl and inefficient use of space and resources threaten to raise municipal expenditure requirements to unsustainable levels.
- In Beira, lack of a strategic urban development plan contributes to development in inconvenient and high-risk locations like unprotected low-lying coastal areas.

Public Infrastructure

Challenges in the provision of public infrastructure include:

- Lack of strategic approach to climate resilience across sectors contributes to accelerated wear and tear, and results in increased economic risk and maintenance costs, and shortens the lifespan of infrastructure investments.
- Tariffs are too low for O&M cost recovery, much less capital cost recovery (see chapters 1 and 2 for budget figures, and future revenue/expenditure estimates).
- Cross-subsidies are required to bolster essential but non-self-sustaining services, but even where approved are not consistently transferred.
- Primary focus is on centralized service delivery despite the government not having the financial and management resources to fully meet demand.

Public Services

Challenges in the provision of public services include:

- Few operators; A lack of government support for private sector involvement outside of the energy sector has caused utility provision in many other sectors

to remain within the purview of the state.[420] Despite the fact that significant gaps in public utility provision exist, the government has done little to actively support the development of private sector providers as decentralized approach to service expansion.
- Lack of awareness of business opportunities; while the government does have significant experience handling donor funds, it lacks experience in PPP management and private sector development.
- Limited access to finance; many public utilities in Mozambique are not financially self-sustaining and thus are not attractive targets for investors.

4.6.3 Project Level

The following issues are often encountered with respect to project conceptualization:

- Projects are too small and often fail to capture economies of scale
- Poor project packaging; the Government of Mozambique has had difficulty properly formulating and marketing projects to investors.
- Material Costs/Labor Productivity: construction costs in Mozambique are higher relative to neighboring countries.
- Permitting: the development approval process in Mozambique requires developers to navigate a maze of permits and fees across numerous regulatory offices. The process is both unnecessarily lengthy and expensive.

4.6.4 Municipal Capacity

The following issues are often encountered with respect to municipal capacity:

Land use planning

Management and enforcement are major issues. The proliferation of informal settlements into undeveloped and hazard areas impedes development and poses significant public health risks. The proliferation of unregistered, informal, and illegal housing imposes costs on the real estate market, makes tax collection difficult and impedes the ability of the municipality to properly manage land resources. Unregulated urban sprawl generally threatens to increase the costs of utility provision and administration.

Tax collection

While Beira receives transfers from the Government of Mozambique on an annual basis via the Intergovernmental Compensation Fund, federal law also provides municipalities substantial financial autonomy with regards to their own local revenue bases.[421] Law 1/2008 sets substantial restrictions on debt financing for municipal governments.[422]

In addition to service tariffs for utilities, general tax and non-tax revenue sources include:[423,424]

- Individual Municipal Tax (IPA) – functionally speaking, a poll tax collected at the state level on both citizens and foreign residents between the ages of 18 and 60. Criteria for application consider occupation and ability to work. Tax rate is variable by municipality.
- Municipal Recurrent Immovable Property Tax (IPRA) – a property tax that is applied as a proportion of assessed property value; the rates are 0.4 percent for residential buildings, and 0.7 percent for all others.
- Levy on Economic Activity (TAE) – a tax applied to any commercial, manufacturing, or service transaction.
- Municipal Tax on Vehicles (IAV) – a tax applies to privately owned vehicles.
- Municipal Sisa (ISISA) – a tax applied to any transaction involving the transfer of property rights, to be paid by the acquiring party.
- Improvements Contributions – a tax levied on imputed increase in property value as result of public works projects in the vicinity of the property.
- License fees
- Tariffs on the provision of publicly-managed services and utilities

A 2010 study of Beira's fiscal base estimated that in 2009, the municipality was exploiting less than 50 percent of potential revenues.[425] While this has likely improved somewhat, it also likely remains a substantial problem given Beira's high rate of urbanization and large informal settlements. Efforts to fully take advantage of the tax base are integral to city's financial sustainability.

Within the sphere of municipal finance, it is often the case that municipalities rely too heavily on non-tax sources of revenue (fiscal transfers, license fees, fines, etc.) relative to tax revenues.[426] Weimer (2012) explains, consistent overreliance on block grants from the central government can lead to spending patterns that are not sustainable relative to the amount of revenue that the municipality is able to derive from the local tax base, leading to solvency risk should the size of central transfers shrink.[427] Weimer (2012) notes that Beira prioritizes the collection of property taxes, but that this revenue source remains unexploited to a substantial degree; high rate of urbanization and large informal settlements pose a threat to success in this area. Beira's city government also stands out with respect to other city governments by virtue of making an effort to prioritize balance between fiscal revenue and non-fiscal revenue.[429]

Provision of services

While grid coverage in water and electricity has been growing steadily, it is not clear that utility service coverage is growing faster than demand for services. Demand gaps across sectors are significant. Substandard service in the water and sanitation sectors poses significant public health risks.

Insistence upon centralized public utility provision is one impediment to growth. Small private providers move to meet demand across sectors, but they are generally unsupported and unregulated by the federal government or the municipality.

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Chapter 5

Impacts of Financing Instruments at the Financial System Level

5.1 Impacts on the Financial System

Impediments to Financing via Public Debt

Due to solvency concerns at both the national and local levels, debt financing has been difficult in Mozambique. Issuing government debt, for example, in the form of treasury or project bonds is challenging for several reasons.

Although interest rates on government debt securities have been declining over time, as has the proportion of annual revenues made up of grant money, the Government of Mozambique is still not solvent without grant money (see Appendix A). This presents a significant risk for investors, given that Mozambique's ability to meet its financial obligations is dependent upon regular international donor transfers.

Credibility is also a significant issue. Recently in January, the Government of Mozambique indicated its intent to voluntarily default on a USD 727 million Eurobond issued in order to refinance a USD 850 million-dollar loan issued by Credit Suisse and VTB Bank to the state-owned commercial fishing enterprise Ematum. Fishing yields did not achieve the requisite level to allow Ematum to meet its service obligations on the original loan. The Government of Mozambique, which had guaranteed the bonds, did not have the financial means to do so either.[430] The debt was refinanced via the aforementioned Eurobond. Shortly after, Mozambique indicated an inability to meet its debt service obligations on the bond and revealed additional and previously undisclosed sovereign debt of USD 1.4 billion, resultant from borrowing by state-owned enterprises.

The current state of affairs with respect to the bond has the Government of Mozambique fighting its creditors over its debt obligations. The government insists that being forced to service this debt would impose an undue financial burden upon the state, while creditors insist that they will not consider relief or restructuring until Mozambique completes a full audit of its net fiscal position and takes steps to prevent a similar incident in the future. The IMF is withholding any additional financial assistance, making it contingent upon Mozambique taking steps to reduce its debt, and increase transparency.

In Mozambique, restrictions are placed on municipal debt for many of the same reasons. Even in the case where a municipality might appear to be a generally credible borrower, the state's inability to serve as a credible guarantor of municipal debt, and the likelihood that a municipal default would place an undue financial burden on the national government has led to federal restrictions on municipal borrowing.

Recurring Costs

Not only do the initial investments in housing and infrastructure frequently represent too-large and unrealistic expenditures, the recurring costs of operating and maintaining infrastructure are often beyond the means of the state. Although it is likely that the state can improve both upon tax collection and administrative efficiency, it is not entirely clear that enough fiscal space can be gained to substantially impact the affordability of simultaneous large infrastructure investments across multiple sectors. Thus, the pace of public sector development must match the general fiscal capacity of the state.

Additionally, the economic feasibility of many investments is dependent upon the success of investments across multiple sectors, especially in light of Mozambique's climate change vulnerability. This is the nature of the strategic challenge in Mozambique: specifically, reconciling immediate needs with the fact that some development efforts must necessarily precede others. A prime example is Mozambique's transportation infrastructure, much of which is underdeveloped. In cities like Beira that have a large degree of risk exposure due to climate change, the lifespan

of transportation infrastructure is substantially impacted by whether or not complementary measure are undertaken to prevent flood damage to city.

Statistics on the national government's recurring operational and debt service costs are available in Appendix A.

Systemic Issues

Systemic issues that affect development include poor land resource management, and a convoluted and high-cost permitting process, both of which serve to delay and increase the costs of projects as they sit waiting for official approval. With respect to land resource management, poor record keeping and enforcement around land usage often leads to disputes between developers and squatters. The permitting process in Mozambique often involves obtaining authorization from multiple bureaucracies; wait times and permit fees are both unnecessarily high, and might possibly impede small developers, for whom the margin between affordable and unaffordable is much smaller, or potentially encourage illegal development.

The Government of Mozambique additionally suffers from a lack of experience in properly managing and implementing PPPs or state-led investment to serve strategic development objectives. Illustrative in this regard is the experience of FFH whose initiatives and partnerships, have largely failed to address housing stock shortages for all but the wealthiest Mozambican households. The recent Ematum financing fiasco demonstrates the government's level of competence in managing debt.

With regards to the national economy, overreliance on small pool of commodities, an underdeveloped tax base, and underexploited commercial sectors have hampered the strength of the economy; strong real growth has tended to somewhat hide the fact that Mozambique must diversify its economy and revenue sources. Part of this effort will involve strengthening the institutional infrastructure surrounding tax revenue collection. In 2013, when the grant-to-total revenue ratio was low relative to previous years at 20 percent, the government would have had to increase revenue from taxes by between 23 to 27 percent to make up the revenue provided by grants.[431] This is not an unreasonable goal given that tax collection in Mozambique is often poor.

Municipal debt in Mozambique is highly restricted because of the threat of solvency issues at both the local and national levels. However, it is not clear that a large city such a Beira would not be able to provide a reliable revenue stream adequate to consistently service small amounts of debt. Beira tax base remains unexploited to a great degree. Additionally, loan products that do not require a guarantee from the central government are available; AFD offers direct, non-sovereign loans of duration 15-20 years.[432] It appears as though the preference for the issuance of such a loan would be for projects geared toward capacity building and improving the financial self-sufficiency of the municipality. This simultaneously reassures creditors about future ability to repay funds, and grows the fiscal base for the city.

5.2 Impacts on Sectors

Systemic Issues in Housing

Costs of housing are driven up by a dearth of zoned plots. The state has been slow to zone plots in quantity, and in way that is consistent with strategic objectives regarding housing supply and sustainable urban development. The result has been rising costs as high-income households compete against low-income households for developable land.[433]

Additionally, construction materials are often imported, and so purchasers must often contend

with significant price volatility over time. Finally, construction expertise for large, modern housing developments is often provided by foreign firms, meaning that development in the housing sector in Mozambique is often contingent upon successfully soliciting foreign interest.

Housing Developers

Formal housing in Mozambique is largely financed via market mechanisms, and often by foreign firms. Government-led efforts to develop mid- and low-income housing have been small and infrequent. Much of the population builds their own homes incrementally, and by direct expenditure.

Problems in this sector from the perspective of developers include an inability to take advantage of economies of scale. This is due to the nature of the market, and the nature of regulatory environment. Systemic barriers to an efficient pipeline process, which contribute to cost uncertainty, are detailed in the previous section. Additionally, we have discussed elsewhere in this report that very little credit is extended to the construction sector generally in Mozambique, which suppresses speculative development of housing. The result is that the housing sector in Mozambique appears to be haphazardly-placed small developments of high-end for-purchase housing, meant to cater to the immediate demand of high earners.

Home Buyers

The lack of credit available to low-income households looking to purchase or construct housing likely compounds the issue by suppressing market demand for low-income housing. Making credit available to low-income borrowers is difficult, however. The default rate for loans in Mozambique is generally low, because of highly discriminatory lending criteria. However, the experience of FFH in issuing lower-rate mid-high tenor housing loans to lower-income customers is a cautionary tale; in 2011, FFH reported a default rate of 30 percent as a result of such products still overwhelming the ability of low-income households to pay. [434] Non-performing loans generally were at 3.5 percent of all issued loans in 2012, which was up from 1.9 percent in 2010.[435] While interest rates have declined over the years, they are still only marginally affordable, and increasing loans to households with questionable credit may serve to drive them back up.

Low-income Mozambican households spend an estimated USD 15,000 over the course of a lifetime on home construction and improvement. This is indicative of most Mozambican households only being able to set aside a small amount of cash on a monthly or yearly basis to invest in home construction or improvement. Large numbers of Mozambicans have no financial assets, are employed informally, and receive low and irregular wages. Consequently, they do not meet minimum standards for loans, and likely would not be able to consistently meet their debt obligations even if these standards were lowered.

Unsecured microcredit products are available but are not likely to solve housing demand for several reasons. First interest rates are high, because the loans are not collateralized. Generally, microloan volume is negligible relative to the financing gap (in 2013 it was estimated at USD 74.1 million nationally).[436] Finally, the supply of formally constructed low-income housing stock is virtually non-existent. Therefore, prices of existing housing stock would mean that microloans would in any case be insufficient to properly finance the purchase of a home.

Transportation

Demand for services in this sector is high, as evidenced by the fact that even existing mass transit options that have high cost-to-quality ratios are well patronized. Based on existing characterizations of the mass transit sector, there is reason to believe that it may be possible to realize financial sustainability with a large effort to improve efficiency. As of

right now, the transportation sector in Beira, as in many other Mozambican cities consists of unregulated private operators. Regulation to reduce operating costs and increase service quality by devising efficient spatial coverage, and by addressing maintenance standards, vehicle type, fuel efficiency, etc., could bring costs in line with revenues. Because transportation services are consistently well patronized, the use of credit in this sector to build a viable market is worthy of further exploration.

Energy

There is a lot of investor interest in Mozambique's energy sector. Because there is a lot of regional demand for electricity produced in Mozambique, revenue streams in this sector are relatively more stable. Additionally, because this sector is export-facing, it is relatively easier for firms in this sector to finance in foreign currencies and avoid the volatility of the MZN.

However, this does not generally solve Mozambique's problem of a significant demand gap for domestic service. With regards to Mozambican households, EDM is often unable to charge cost-reflective tariffs, and this makes development in that market segment unsustainable. It is unclear whether cross-subsidies using export revenues might be a viable financing option for service expansion.

Water & Sanitation

Investment in this sector is difficult because revenue streams are composed primarily of tariff revenues and service fees. Consequently, the ability to charge cost-effective tariffs is of paramount importance. Unfortunately, this tends to restrict the expansion of these services to those with ability to pay. Because these are critical sectors, the federal government and local governments must often push forward with development despite high investment costs and low-cost recovery. Additionally, they often fail to capitalize upon opportunities to reduce costs by taking advantage of economies of scale (via condominial facilities, or by using strategic plans to ensure the most efficient construction of infrastructure and the least amount of wear and tear over time).

5.3 Challenges faced by different actors

Resilient and Green Infrastructure

Investment in resilience measures will be costly (current maximum estimates of Beira's need are over USD 350 million) and in places like Beira, it is also a pre-requisite for successful investment in many other infrastructure sectors, whose exposure to climate change-related economic loss is substantial. This loss threatens the lifespan of new infrastructure, and also threatens the fiscal sustainability of urban development.
One of the primary issues facing the city in its attempt to attract investors to assist in the construction of measures that promote resilience, is the difficulty of deriving revenue streams from many of the coastal defense measures. Although projected economic loss due to climate change is substantial, and risk exposure is likely to increase as the city grows, the capital required to pursue a full range of mitigation measures is currently well beyond the means of the municipal government.

The National Disaster Management agency (INGC) recommended the pursuit of direct mitigation measures as opposed to disaster insurance, given the nature of the risk Beira faces (routine and significant annual flood and storm-related damage). The agency published insurance cost estimates for Beira that ranged from USD 6-17 million annually by 2030, in the event that the city sought to establish risk transfer mechanisms for outlier events. Estimated of risk exposure and expected economic lost at that time led INGC to conclude that such expenditure was not cost effective. However, it may be prudent to re-examine insurance options in light of updated data on climate change and urbanization in Beira.

Investment in green infrastructure stands to presents several challenges in a development context. In the case of decentralized options for addressing utility provision, it is important to consider the potential of encountering increased operations and maintenance costs. For example, the operation of solar energy systems on a neighborhood level might require the electrical utility to increase its infrastructure maintenance and monitoring capabilities in order to properly manage decentralized energy production infrastructure. Additionally, adopting hi-tech solutions in a developing country such as Mozambique would likely require the utility provider to import replacement parts and maintenance expertise for a substantial period of time, which can have implications for the near term financial sustainability of the investment. Finally, such solutions are likely to exhibit some economies of scale, which makes the cost-benefit/tradeoff calculations for a resource-constrained municipal government facing a large demand gap somewhat less clear. Affordability is key concern for both consumers and for utility providers.

A private infrastructure market centered around novel technologies is likely to need market-making support from the federal government, which Mozambique has struggled with in the past. Regulation of private markets has also been a struggle for Mozambique. Small, private sector providers exist across many sectors, including sanitation, water, and transportation, and many engage in practices that result in negative externalities. In the sanitation sector, improper disposal of waste and related environmental impacts has been a concern. In the private water sector, lack of oversight has led on occasion to improper management of water resources (well drilling and similar). In the transportation sector, lack of oversight has led to inefficient service, unsafe and unaccountable driving, and tax evasion. Finally, expansion of government support for green urban solution markets, and oversight of decentralized infrastructure and private sector business will require an increase in institutional capabilities which is likely to be a substantial recurring cost.

In short, securing the sheer volume of financing necessary to directly finance green initiatives across sectors appears to be a daunting task. Solutions to this problem might involve the Government of Mozambique taking a small-scale, experimental approach to applying green technologies, with the primary objective being to identify for private sector partners the circumstances under which such initiatives might be both scalable and profitable.

5.4 Target Areas for Financial Sector Improvement

Financial sector development is largely constrained by several key issues:[437]

- Lack of competition/ institutional diversification (high degrees of stratification in the commercial banking sector, with several large institutions dominating, and very few quality small scale local banking institutions. Similar for insurance markets and pension funds). Therefore, there are dearth of low-cost financial instruments and services available to individuals, households, and small and medium enterprises.
- Poor macroeconomic indicators (interest rates, inflation, and exchange rates)
- Lack of government support for financial market access, including poor tax revenue source exploitation, leading to limited funds for supporting financial market development (safety nets and loan assistance)
- Citizenry that largely lacks the means to obtain the documentation (of assets, earnings, and credit history) necessary to participate in financial markets

Progress in the financial sector has been made in recent decades. The Technical Assistance Project for the Financial Sector (2005-2007) strengthened regulatory frameworks for financial sector; bolstered oversight mechanisms for banking; made provisions for the resolution of commercial disputes; implementation International Financial Reporting Standards; created the

Office of Financial Information of Mozambique; implemented an electronic funds transfer system; and committed to increasing transparency in financial reporting and in the implementation of new monetary and exchange rate policies. However, there remains room for improvement.[438]

Borrowing heavily from the Republic of Mozambique Proposal for a Strategy for the Development of the Financial Sector 2013 – 2022, we recommend the following broad goals for financial sector development, with clearly defined benchmarks to be set appropriately after further assessment:[439]

- Improve the financial literacy of non-banked populations and improve their access to financial markets by assisting them with building the necessary financial history profiles and obtaining proper documentation for all financial transactions and asset holdings.
- Pursue greater integration of technology in both the public and private sectors for the purpose of collection, maintenance, management of information related to transactions, macroeconomic performance, and financial sector performance at the macro level; and at the micro level, household or individual data (earnings, savings & other assets, home ownership, etc.) allowing individuals, households, and small enterprises to participate in financial markets and allowing public and private financial institutions to better tailor new offerings to underserved market segments
- Decrease macroeconomic volatility and increase financial sector competition in order to increase the tendency to transact in local currency and to reduce the cost of financial products
- Increase private investment, and formalize and develop largely informal markets (agriculture and housing especially) and analyze existing formal markets (especially natural resource and tourism sectors) for opportunities for continued expansion
- Increasing the ability of the government to provide safety nets and financial support for development programs by expanding its fiscal base

END NOTES

[430] Frances Coppola, "Mozambique Is About To Default On Its 'Tuna Bond,'" Forbes, accessed August 22, 2017, https://www.forbes.com/sites/francescoppola/2017/01/17/mozambique-is-about-to-default-on-its-tuna-bond-again/.
[431] See Appendix A
[432]"The Financing of Local Government: The Case of Beira" (Agence Française de Développement, March 17, 2016).
[433]"2015 Yearbook Housing Finance in Africa: A Review of Some of Africa's Housing Finance Markets."
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[435]"2013 Yearbook Housing Finance in Africa: A Review of Some of Africa's Housing Finance Markets."
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[437]"Republic of Mozambique Proposal for a Strategy for the Development of the Financial Sector 2013 - 2022" (Government of Mozambique, April 2013).
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Chapter 6

Alternative Financial Instruments

6.1 New Challenges, Approaches, Instruments

6.1.1 Analysing new housing and infrastructure development challenges, issues, priorities and financing opportunities and solutions in the city

There are numerous opportunities for the City of Beira in conjunction with partners to address factors that inflate the cost of housing construction and real estate, and infrastructure development, and therefore inflate financing needs and negatively impact overall market activity. The following are key issues in this sector, and should be prioritized:

1) Lack of a strategic urban development plan that would reduce costs to the city associated with unregulated development – this means that follow-on development of public infrastructure must accommodate urban sprawl, rather than follow the most efficient layout possible.
2) Underdeveloped municipal information and records management, and oversight/ regulatory enforcement capacity, which would increase the ability of the local government to manage urban sprawl and fully take advantage of its tax base.
3) Scarcity of zoned/authorized plots – leads to unnecessary market competition (given Mozambique's vast quantities of undeveloped land) for zoned plots, which drives up prices of housing.
4) High permitting fees and substantial time cost of obtaining permits – the permitting process in Mozambique is estimated to cost as much as 8 percent of property value and take roughly 6 weeks on average. This likely also contributes to illegal development, which also damages the ability of the city to maintain oversight of urbanization and properly collect taxes.
5) Inefficient labor/high materials costs – Cost premiums here are largely the result of the fact that planning, management, engineering and construction expertise, as well as construction materials often must be imported.
6) Lack of government-led support for low-income housing stock – this lack of support for lower-margin homes means that prices for new homes in Mozambique tend to be high relative to the purchasing power of the average household.
7) Lack of access to financial markets for lower-income households.

6.1.2 Analyzing approaches which could reduce the costs of affordable housing and narrow the affordable housing gap in the city, including market-oriented solutions (e.g. lowering the cost of land, construction, operations and maintenance, and financing)

The following are solutions that correspond by number to the issues in section 6.1.1:

1) Formulate and enforce of strategic plans so that unplanned development does not increase administration costs in the future. Even allowing for self-construction on plots that have been made available in low-risk zones would improve economic loss due to storms/floods.
2) Increase the information management, oversight, and enforcement capacity of municipal departments responsible for taxation and regulation.
3) Increase land management capabilities in order to increase the supply of zoned plots reign in price inflation due to excessive market competition; and to increase regulatory oversight of urbanization.
4) Streamline the permitting process and lower costs to make sure that municipal administration does not remain an additional barrier to the legal construction of housing for smaller firms, and lower- and middle-income households.
5) Encourage investment in materials production to reduce the volatility of prices, and efforts to support building robust labor markets around construction, engineering, finance, etc. will be necessary over the long term to develop a truly robust and self-sustaining housing development sector. In Mozambique, this is a problem that revolves primarily around market-making

and commercial/institutional knowledge; the country has vast reserves of raw materials such as timber and aluminum that can be used in housing construction.

6) Explore the viability of credit-based solutions to meeting housing demand have largely ignored the fact that professionally-built homes that are within the means of low-and middle-income households are rarely built. It may be that lowering the implied debt burden of buying a house might make debt financing an option for lower-tier earners. Given that market competition for serviced plots has been an issue, homes at lower price points will likely need to be shielded by policy from higher-income purchasers to prevent property flipping.
7) In the event that housing becomes more affordable, credit products that are underwritten or subsidized by the government will likely be necessary to support the market.

6.1.3 Assessing opportunities for launching and developing new instruments which support low carbon and climate resilient development

Much of Mozambique's energy production is already green. However, as previously mentioned, poor cost recovery in the domestic market is an impediment to sustainable expansion of provision infrastructure. Because there is strong demand for energy exports, Mozambique might explore opportunities to implement cross-subsidies.

The water and sanitation sectors present substantial opportunities for improvement. Integrated management of land/forest, agriculture, natural resource, sanitation and water sectors is consistent with national strategic objectives and would likely contribute to environmental sustainability and resource security. Approaches in these sectors should be primarily concerned with community resilience, the conservation of natural resources, and public health.

Because tariffs are the primary sources of operating revenue in these sectors, effort should be consistently made to improve collection. However, providers should also take steps to defray costs, and can do this via the application of green solutions. There are additionally opportunities to change unsustainable household behavior that require minimal investment in large fixed capital assets.

Examples include investment in decentralized and low-maintenance systems (such as latrines, and household graywater and rainwater systems) that are environmentally friendly and require minimal service. The municipality can also establish alternative cost recovery revenue streams by making use of recyclable materials collected as part of a solid waste management program. This includes organic waste for compost and fuel (which would cut down on use of artificial fertilizers and environmentally unfriendly cooking and heating fuels, respectively); metal, glass, and plastic for household products and building materials; and captured methane from landfill decomposition.

Forming lucrative business opportunities in these sectors may allow the Mozambican government to negotiate concessions for environmentally sustainable development. These concessions might include taxes and fees to support research and holistic management. However, we reiterate that government support for private infrastructure markets has been lacking.

6.2 Improving Financial and Technical Support at the City Level

The following are suggestions for improving efficiency and effectiveness of financial and technical support:

1) Subjecting budgeting and development to a strategic plan for sustainable and resilient urban development, while prioritizing high-risk and critical sectors, and emphasizing evidence-based justification for investment will ensure the

most effective use of public funds.

2) Identifying problem areas for illegal development and increasing enforcement will ensure adherence to the development master plan and reduce the growth of administration costs as the city grows.
3) Identifying opportunities to decrease reliance on central government transfers and donor grants by increasing the amount of locally-sourced revenues in the municipal budget. This will serve to make the municipality more economically resilient/self-sufficient, and a more attractive borrower. As efficiency begins to take hold, the municipality should explore opportunities for small, sustainable amounts of municipal debt to assist with institutional growth and establish itself as a credible borrower.
4) Contracting external consultants on a sector-by-sector basis to provide guidance to municipal government and public utilities on organizational efficiency, problem troubleshooting, and sector-specific organizational best practices.

6.3 Opportunities for International Financial Institutions and Agencies

This section will seek to identify opportunities for international development agencies, the private sector, and the German Financial Cooperation to support cities in developing their resilient and sustainable housing and infrastructure strategy.

6.3.1 Support to financial sector development

There are gaps in the market for debt financing with respect to municipalities and small businesses that have the means to sustain small debt commitments but do not have either the financial history or asset requirements necessary to qualify for loans. Identifying these gaps and proposing solutions that connect international/national financial institutions to lower-level borrowers at the provincial or city level and connect national financial institutions to the local banks and microfinance institutions that support small businesses would help in creating diversity and depth in the national financial market.

Opportunities

International development institutions can help Mozambique identify untapped opportunities for growth based on past experience and exploit them with new economic and financial instruments. For example, in countries with large agricultural sectors, support for agriculture has proven to be essential to pro-poor growth. In Mozambique, it is a relatively underdeveloped sector. It is often the case that such growth programs are implemented at the local level and adapted to the idiosyncrasies of the local economy before they are scaled.

Financial sector growth must serve a purpose: to support the growth of the local economy in a way that is consistent with national development objectives. For this to happen, several steps must be taken in advance. First, the types of financial instruments being demanded, the volume of financing being demanded, the objectives being served, and the means of the typical borrower must be determined on sector-by-sector basis. Secondly, it must be determined whether products that suit a typical borrower in a specific sector can be devised, the terms of which would be amenable to the creditor as well. And thirdly, it must be determined whether the creation of a financial instrument to support the objectives of certain sector is in concordance with larger national development goals (which are preferably broad and non-restrictive).

International development institutions can contribute to building out credit markets by offering subsidized loans to Mozambican institutions in order to allow them to offer low-cost loan and microloan products to households and local businesses.

For this to happen successfully, information sharing regimes must exist to reconcile the requirements of local and national

governments, local and national financial institutions, non-government actors, private-sector enterprise, and households. Unilateral attempts to build the financial sector without being cognizant of the demands and requirements of major market actors will be unsuccessful.

Risks

For sovereign and multilateral development institutions, consulting on opportunities for the Mozambican financial sector to venture into speculative investment in sectors with growth potential and lending to households and small businesses presents virtually no risk. Such initiatives would certainly increase the asset portfolio risk of the Mozambican financial sector; lending to developers in infrastructure and service markets that seek to cater primarily to low-income clients carries the risk that solvency issues will affect the investment; lending to small businesses and low-income households carries relatively greater risk of default.

These risks would be passed on to sovereign and multilateral development institutions should they decide to insure or subsidize these loans as a method of incentivizing Mozambican institutions to cater to these clients.

6.3.2 Financing opportunities in the city

Rather than opportunities for indirect involvement via the financial sector, this section will broadly consider opportunities for direct involvement in infrastructure and service markets in Beira.

Opportunities

The authors of this report posit that flood management, housing, and water and sanitation sector development are most critical to public health and are deserving of particular attention. Each of these sectors require massive expenditures beyond the means of even the national government. Based on the cost estimates provided in this report, high population growth coupled with highest-possible prices could precipitate financing demand in the range of USD 2 to 10 billion and possibly higher, over a relatively short time horizon (roughly 20 years) just for infrastructure construction costs in these sectors. Service quality in the water sector is inconsistent, though efforts to close the demand gap for drinking water have been aggressive. The sanitation sector remains extremely underdeveloped and poses a massive risk to public health when combined frequent flooding, and poor water infrastructure.

Opportunities in these sectors are largely elaborated in Chapter 2, and include addressing large development gaps in the capacity to treat and deliver drinking water; in the ability to manage and treat human waste; in the ability to collect and recycle solid waste; and to protect public infrastructure and resources from extreme weather events. A particular focus of this report is on the low-income housing gap, which is massive and growing due to a lack of development and a lack of low-income housing finance options being extended to both developers and would-be home buyers.

Risks

The financing gaps in these sectors are massive, and with regards to public utilities, it is not clear that the City of Beira has the project conceptualization and management to successfully formulate and implement complex infrastructure projects; the administration capacity to fully monitor and maintain infrastructure; and the tax base and the asset management capability to ensure the solvency and full functionality of public utilities.

The risks in these categories for the municipality and its development partners that any new development of sufficiently large size and cost and requiring substantial management and operations capacity will strain the municipality's capabilities and fall into inefficiency, disrepair, and insolvency without constant oversight and financial support.

Risk would be reduced by focusing relatively more on building the municipal capabilities detailed in this chapter and solidifying them in practical settings by applying them to smaller

pilot projects in these sectors. Pilot project suggestions are given in Chapter 7.

Private sector- led initiatives by firms with expertise in specific public infrastructure and service sectors may not face the project implementation and asset management issues as the municipality, but they will face the same financial risk resultant from providing services to the low-income market segment.

6.3.3 Financing Opportunities for Building City Capacity

Opportunities

A key initiative will be assisting the City of Beira in identifying a series of clearly delineated steps within its means that would work towards the larger goals outlined in the 2035 Master Plan. It is important to recognize that the city has largely lacked a strategic planning capability and will likely require assistance in solidifying the steps outlined in Chapter 8 of the 2035 Master Plan, to include assistance with regards to identifying key objectives, and incorporating accountability mechanisms to ensure that public funds are being spent efficiently.

Boosting general administrative and analytic prowess is important for competent asset management. It is necessary for Beira to be able to accurately assess the performance of its public utilities and make corrections when necessary. Key bureaucracies to target are those related to development permitting (to ensure efficient and low-cost service); land management (to regulate urbanization and provide zoned plots); and tax and tariff collection (to ensure a robust tax base for the municipal government). Please see Chapter 1 of this report for an evaluation of unrealized tax revenue potential; here, it is sufficient to reiterate that Chimunuane et. al. (2010) estimated based on an assessment of seven major revenue instruments that Beira's unrealized tax revenue potential exceeded 87 percent.[440] A current model for a partnership with these goals is that between CMB and Vitens Evides international in the water sector, in which improved grid management and revenue collection are project objectives.

Another opportunity to bolster capacity includes assisting the City of Beira in appropriately assessing, packaging and marketing investment opportunities to investors, which is another area in which the government consistently has difficulty. Partners should also recognize that imparting knowledge of the planning and implementation process is just as vital to sustainable urban growth as the projects themselves; such a project planning and management capability ensures that the city is able to adapt and identify new requirements and opportunities in the face of shifting circumstances.

Donor involvement may take the form of procurement and installation of data management technology systems and related technological training.

Risks

Risk in this area of development is relatively low, as it is less capital-intensive than public infrastructure investment and has low recurring costs. In order to ensure success, consulting developers and donors should ensure that the organizational strategies and data management practices instituted through the partnership are not dependent upon perpetual technical or financial support from the consultant and are appropriate for managing low-tech operations.

6.3.4 Partnership opportunities as well as knowledge development and sharing in financing FRUGS

Opportunities

A partnership between UN Financing for Resilient and Green Urban Global Solutions (UN Habitat and partnered development institutions), MICOA, INGC and CMB, would promote of a holistic/integrated approach to development, environmental sustainability, and risk management that reflects the co-

dependent nature of the objectives as laid out under multiple national policy frameworks. This additionally ties together relevant international-, national- and local-level stakeholders within a relatively uncluttered vertical reporting structure, with each actor having the capacity to identify relevant third parties at each level.
A challenge to forming partnerships will be identifying relevant national and local government agency stakeholders and deciding at what stage of project development it is appropriate to involve them.

The primary purpose of knowledge sharing should be to identify ideas for projects that support national development goals, and then formulating broad strategies for pursuing those projects. Stakeholders at the project level whose primary responsibility is to determine the details and mechanics of project implementation and operation should be involved at later stages to ensure that projects are adapted to suit objectives, and not the reverse.

Risks

It bears repeating that the municipal council of Beira (CMB) will be an essential player in the process of identifying development opportunities. Given that the local economy is small, and the government operates with minimal fiscal space, local demand and market support for projects is essential to their sustainability. CMB is the entity best able to determine these things in the local context.

6.3.5 Opportunities for launching and developing new instruments (e.g. assessment tools for green and climate resilient cities, green building and housing index)

Opportunities

It is unclear whether there is a specific body in either Mozambique generally, or Beira specifically that is tasked with aggregating information gathered and lessons learned in the course of implementing green and climate resilient projects. Appendix A contains just a sampling of development projects in Mozambique, but it is clear that there is an extensive list of projects, particularly those under the auspices of the Pilot Programme for Climate Resilience and the Cities and Climate Change Project, that contain valuable information.

Risks

It is important to note however that each level of government in Mozambique often lacks basic information management capabilities. The development of specific assessment tools for green infrastructure is essential, but such capabilities need to be extensions of general administrative capacity in order to be sustainable; this can be thought of as laying the foundational basis for an organization that is capable of developing and applying new tools to meet its needs.

For example, FIPAG lacks accurate records regarding the spatial layout of Beira's municipal water grid, and CMB does not have complete records documenting development and land use within the city limits. Trying to implement "green" accountability or audit mechanisms in the absence of any ability to maintain complete and accurate records is likely a waste of time and resources.

Chapter 7

Project Identification

This chapter will identify national and local priorities for the development of infrastructure and services; it will elaborate a set of criteria for determining those priorities and provide templates and recommendations for specific projects that serve as targets for donor involvement.

7.1 National Priorities for Housing, Infrastructure and Urban Services

It is essential that the Government of Mozambique and its development partners recognize that there is no market for truly low-income housing (either rental or purchase) in the country. Because of highly exclusionary lending criteria, firms engaging in speculative development in Mozambique are representative of the top tier of firms that cater exclusively to upper-middle and upper income households. This accounts for most of new housing construction, including housing construction that occurs as the result of government sponsored partnerships. The vast majority of Mozambique's citizens are poor and so there is extensive need for both the construction of low-income housing, and for the support of low-income housing markets, including development of a range sustainable household financial instruments that allow people to improve their living conditions.
In identifying national priorities for infrastructure and urban services, priority project identification should revolve around four primary considerations:

1) Whether the sector under consideration is critical to public health and human development.
2) Whether local markets express demand for the identified project and possess the capacity to support it.
3) Whether national and local government have the administrative and fiscal capacity to sustainably manage and operate new infrastructure and services.
4) Whether development initiatives are consistent with national development priorities and strategies for meeting national and local development goals.

This chapter will seek to apply the above considerations specifically with respect to Beira.

7.2 City Priorities for Housing, Infrastructure and Urban Services

This section identifies priority areas for development in Beira based on the criteria elaborated in the previous section. It will also explore the role that climate change plays in shaping development considerations in Beira, which is a port city that regularly contends with a significant amount of exposure to extreme weather events. The development priorities outlined in this section with focus on supporting strategies for mitigating threats to Beira's most vulnerable residents in a sustainable manner.

Housing

There are two main priorities in Beira with respect to housing. One is supporting the creation of a low-income housing market that includes low-cost options for purchase, rental, and self-construction; the other involves addressing the proliferation of shantytowns in unplanned and low-lying coastal areas. Beira's large, and growing, informal settlements are a significant impediment to proper urban development. They inhibit the ability of the municipal government to properly regulate urban growth, collect taxes, and designate and prepare land for development. These settlements additionally encourage the proliferation of unregulated and informal economic activity and impede the ability of the city to provide water, power, sanitation, waste management and transportation services.

Additionally, these settlements pose significant risks to public safety, by exposing large numbers of people in substandard housing to dangerous weather, and also to follow-on dangers of flooding, and water-borne and insect-borne diseases.

The larger these settlements grow, the greater the implied expense for future disassembly and relocation. Beira must move to eliminate these settlements and replace them with planned neighborhoods.

Infrastructure and Urban Services

Infrastructure and service underdevelopment in four sectors in Beira pose the greatest risks to public safety; these sectors are water, sanitation, solid waste management, and flood management.

Haphazardly-constructed and poor-quality water infrastructure often backflows during flooding. It additionally makes it difficult for the city to properly maintain its pipeline network. Frequent service outages force people to turn to non-potable water sources for drinking water.
Beira's sanitation services and sewer network are extremely underdeveloped and of poor quality. Improper disposal of human waste and flooding often combine to contaminate drinking water sources and increase the incidence of waterborne disease.

Beira's solid waste management properly services the majority of the city. However, services are not provided to poor and unplanned peri-urban neighborhoods. Improper disposal of solid waste can impede the function of natural drainage infrastructure and contribute to flooding and drinking water contamination. It also frequently results in pollution due to unauthorized and environmentally unsafe waste disposal (burning and burying).

Finally, eroding and inadequate coastal defense infrastructure (preventing erosion of coastline and managing sea level surges) and flood management infrastructure contribute to high social economic costs to the city during extreme weather events. Severe flooding and storm damage exacerbates the above detailed weakness in housing and infrastructure, in addition to also causing power outages and damaging roadways. In low-lying coastal areas, coastal defense infrastructure can be considered to be pre-requisite for ensuring the survivability of other urban infrastructure; absent coastal defense existing and future critical infrastructure in these areas is likely to be degraded quickly or not function properly in times of need.

Implementing Solutions

Addressing these priority areas is not as simple as repairing and expanding infrastructure and housing and increasing service coverage. It should be noted that the problems detailed above are often co-located; that is, they tend to be the collective result of the proliferation of poor, unplanned, and unregulated urban sprawl into areas that are not ideal for development. These settlements already put significant strain on the fiscal and administrative capacities of the state, and a development strategy that chases this urban sprawl is likely only to result in failure and unsustainable increases in costs.

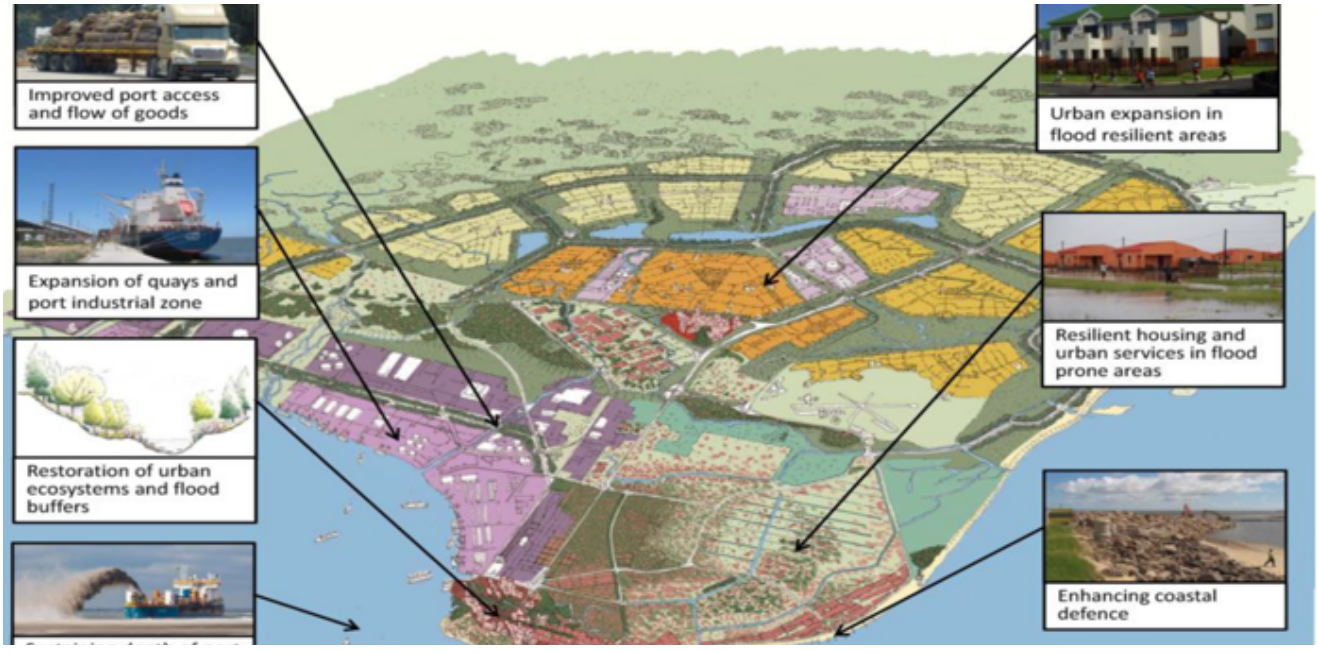
Development should address all of the above areas, with the primary guiding principle being the conversion of sprawling, unsafe, and informal settlements into centrally planned neighborhoods with minimized weather and flood risk exposure that are zoned to be economically viable and for efficient connection to public utilities and services, which will improve human development outcomes and reduce the fiscal burden on the city associated with public service provision.

The 2035 Master Plan (see figure 7.1 above) addresses each of these considerations by proposing that the city expands via the construction of new urban high-density residential areas to the north of the peninsula, in areas that are higher-elevation, which provides natural protection against sustained flooding. Additionally, the suggested spatial layout for future urban expansion is radially outwards from the original city, economizing on necessary transportation infrastructure, and likely also allowing the city to add follow-on infrastructure (in water, power, and sanitation) in relatively more efficient manner, both spatially and economically speaking.

One additional and related area of focus should be increasing the capacity of the state to administrate and regulate urban development so as to make sure this course of action is followed.

Figure 7.1a Beira 2035 Masterplan Proposed Urban Expansion Strategy[441]

Figure 7.1b Beira 2035 Masterplan Proposed Urban Development Projects[442]



7.3 Financing Opportunities for Project Pipelines

Public Sector Solutions in Housing

A government-led initiative to create a market for low-income housing is necessary. The low-margin, high-risk nature of low-income housing has up until now kept private developers out of this area of the market.

The state housing authority's (FFH) attempt to enter the housing construction market and repurpose existing housing stock for sale at subsidized prices to low-income families was short-lived after it proved to be financially unsustainable.[443] A greater examination of FFH's failures in creating a low-income housing market is warranted, but in short, the financial pressures resultant from depleting state-owned property stocks via sub-market rate sales, and then using the proceeds to cross-subsidize loan assistance programs with high default rates proved led to unsustainability.[444]

There are several state-led policy solutions that would begin to address the housing demand gap. The first would be to identify a standardized low-income house template that can be constructed at minimal expense, and for which a substantial portion of the cost can be recovered in the near term based on a typical lower middle-income household budget. In a previous section of this report, we identified a housing construction template using recycled materials that could be constructed for roughly USD 5000. With Mozambique regularly experiencing real GDP growth rates slightly greater than 6 percent, the hope would be that low-income households might progressively grow into having the financial means to purchase such a house as the housing stock gradually expanded at a rate consistent with the growth in capacity of state means.

An impediment to this, or any other government-led solution is the perceived lack of credibility of the Government of Mozambique as a borrower; given recent events, potential bondholders or creditors may be reluctant to hold federal government debt. These relationships must be repaired via efforts to enforce macroeconomic stability and consistently service debt. It will be easiest to establish favorable credit history in sectors where revenue streams are consistent and easily derived (e.g. service sectors that collect tariffs). However, a lack of transparency and improper management have damaged prospects for debt financing even in these areas. Mozambique's complicated national-to-local tax revenue transfer system, which is inconsistent and accounts for too large a proportion of municipal budgets, and its poor track record of properly reporting and documenting public debt has damaged ability of government at both the national and local level to demonstrate consistent fiscal capacity and competent financial management to investors and partners.

Another public-sector option involves creating dedicated policy/economic instruments to fund housing construction, in the form of direct transfers or dedicated grants.

Private Sector-Solutions in Housing

An approach to housing finance that focuses on the private sector is a regulatory requirement that some fixed proportion of all new development is set aside as subsidized housing. There are various ways that this can be incentivized, via special zoning concession, or preference in contract consideration. So far, Mozambique has had minimal success in incentivizing private developers to address low-income housing.

Donor Funds

Because donor funds are typically non-recurring receipts, and small in quantity relative to financing gaps, they are best used for small and non-recurring expenditures. An area where these funds might be usefully applied is in developing the institutional infrastructure surrounding real estate markets and land management, which is currently inefficient, and lacks adequate data management capabilities.

Urban Infrastructure and Services

Encouraging private sector solutions to closing demand gaps will involve government support for private infrastructure markets, which has been lacking. It will be up to the government of Mozambique to identify opportunities for private sector involvement in construction, operations and maintenance that may result in savings for the public, and to solicit private sector interest in those opportunities. Concessions or partnerships that solicit financing via private sector partners are likely better avenues for debt financing of projects; the government's questionable credit and project management histories will likely mean that absent such collaboration, the government may lack the credibility, resources, and operations and management experience necessary to successfully complete such a project.

7.4 Project Identification and Pipelines for Low Income and Lower-Middle Income Housing

Two initiatives elaborated by the 2035 Master Plan are consistent with the recommendations made in this report with respect to housing. The first is the development of structure and zoning plans in order to assist with setting parameters for future project formulation that are consistent with Beira's housing development goals. The second is the creation of a land development company, whose responsibilities will include executing the priorities of the city with respect to land management and preparing plots for housing and business that are zoned for flood safety and easy connection to public services.

The development of a strategic plan that designates zoned areas set aside for Beira's poorest residents to self-construct dwellings will decrease the cost to the city of urban expansion. A city zoning and permitting office can ensure adherence to this strategic plan, as well as to building standards. A city property clerk can ensure accurate record keeping and data management that will assist with proper land management and will assist in the development of a low-income real estate market and will additionally facilitate improvements in the collection of property taxes. As stated previously in chapter 7, the city must make the conversion of unplanned shantytowns into centrally-planned neighborhoods a priority.

Pilot Project: Land Management

Analyses and interviews cited throughout this report have indicated that the municipal government of Beira lacks a formal land management entity capable of meeting the large demand for zoned and serviced plots in timely and cost-effective manner. The effects of this are two-fold: first, it results in substantially inflated costs of development; and second, it provides an incentive, especially for low-income prospective home builders, to circumvent city regulators, which in turn subverts the ability of the local government to accurately maintain spatial data regarding urban expansion.

For this reason, we recommend a feasibility study focusing both on administration and cost to evaluate how the City of Beira would implement a Land Management Authority. We believe that such an office is integral to the ability of the municipality to properly adhere to any strategic urban development plan.

Pilot Project: Housing; The Maraza New Town Project[445,446]

The Maraza New Town project is prospective new neighborhood in a low-lying area in the central-north of the peninsula, adjacent to the airport. The project is an opportunity to showcase urban development techniques and principles consistent with the city's objectives regarding housing, infrastructure, and the environment. The neighborhood will

be formally planned and accommodative of the natural terrain so as to allow the city to take advantage of natural storm water drainage. Each plot will be zoned for easy connection to city infrastructure, and to allow for follow-on, self-constructed expansion of the core housing unit.

The core housing units will be financed and constructed by the housing development enterprise Reall, which has already conducted some market research and has committed to working with Beira to implement the Maraza New Town Project, first by pursuing a pilot project 10 percent of the size of the planned project.

There are several opportunities for donor funding in conjunction with this project. The first opportunity involves donor support for the development of a low-cost housing template, including addressing the shortage of low-cost building materials (elsewhere in this report, we have suggested building materials made from recycled plastics). Relatedly, donor funding may assist with the development of a mortgage product or rent-to-own scheme or may provide financial assistance to Beirans seeking to purchase the constructed homes. Each of these areas are of central importance.

Reall's market research determined that even an interest rate of 15 percent (typical of Reall's offerings, but much below market rate for Mozambican financial intuitions) and an 80 percent loan-to-value ratio, only a small percentage of households – those earning at least MZN 14,000 monthly – can afford a one-bedroom house (at an estimated cost of USD 5,200). Such a household would likely be in the top income quintile.

The following table is borrowed from that report and illustrates the maximum home loan offered by Reall for which a household with the indicated income, spending 35 percent on housing, would qualify.

Figure 7.2 Location of Beira's Maraza New Town Pilot Project[447]

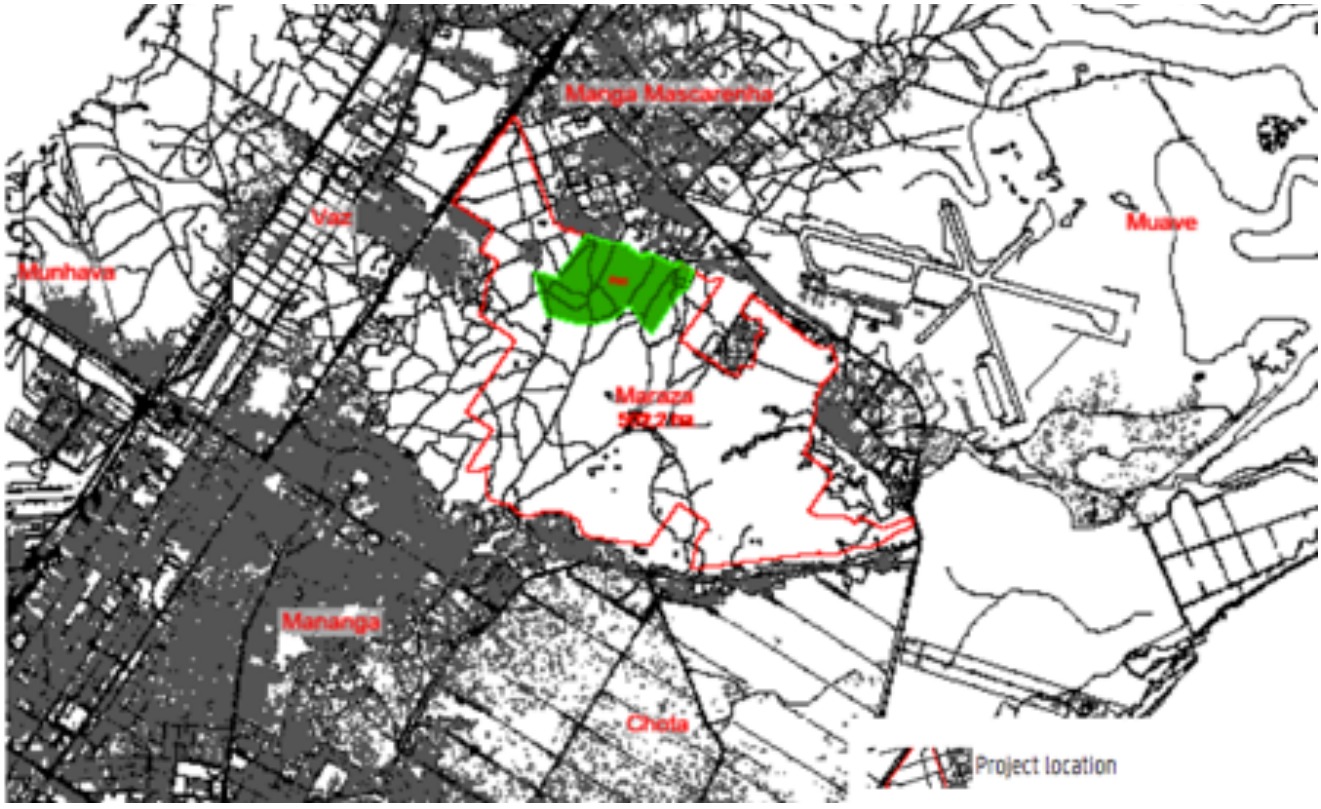


Table 7.1 Affordability based on a 6 years loan at 15% interest[448]

Income - Mzn	35% Max Charged	Max House Loan - MZN	Max House Loan – USD
5,000	1,750	82,762	1,505
6,000	2,100	99,314	1,806
7,000	2,450	115,867	2,107
8,000	2,800	132,419	2,408
9,000	3,150	148,971	2,709
10,000	3,500	165,524	3,010
11,000	3,850	182,076	3,310
12,000	4,200	198,628	3,611
13,000	4,550	215,181	3,912
14,000	4,900	231,733	4,213
15,000	5,250	248,285	4,514
16,000	5,600	264,838	4,815
17,000	5,950	281,390	5,116
18,000	6,300	297,943	5,417
19,000	6,650	314,495	5,718
20,000	7,000	331,047	6,019
21,000	7,350	347,600	6,320
22,000	7,700	364,152	6,621
23,000	8,050	380,704	6,922
24,000	8,400	397,257	7,223
25,000	7,194	413,809	7,524

Based on the above table, it is apparent that lower-income families must have savings to supplement their loan, or receive financial assistance, or receive more favorable loan terms.

Or alternatively, housing developers must offer rental schemes, or a less expensive home.

Each of the following pilot project proposals can be applied to the Maraza New Town Project, which seeks to be a model for pro-poor, quality, and environmentally sustainable urban development.

Considerations by income tier regarding housing construction

Low-income residents are the largest proportion of households in Beira, and for the foreseeable future will likely be reliant, as they have been in the past, on self-construction. Ensuring the availability of standardized guidelines for safe self-construction and ensuring the availability of quality and low-cost building materials will be key to allowing poor Beirans to construct sturdy homes. As has been elaborated elsewhere in this analysis, materials costs are frequently much higher in Mozambique than in neighboring countries, and prices can be volatile as a result of macroeconomic instability.

With regards to lower-middle/middle income households, markets for housing for this income tier are likely thin, with the majority of developer constructed housing targeting upper-middle and upper income Mozambicans.

However, these residents likely have regular (if small) salaries. Exploring opportunities to extend affordable credit and rental assistance to this portion of the market would likely assist in building out both financial markets and housing markets to include Mozambique's small middle class. State support for the supply side of the housing market is also necessary; in addition to providing financial support for lower-income residents seeking to procure housing, the state must also find creative ways to incentive the construction of lower-margin housing for people with limited financial resources and little, if any credit history.

Figure 7.3a Proposed Spatial Layout of Maraza New Town Neighborhood[449]

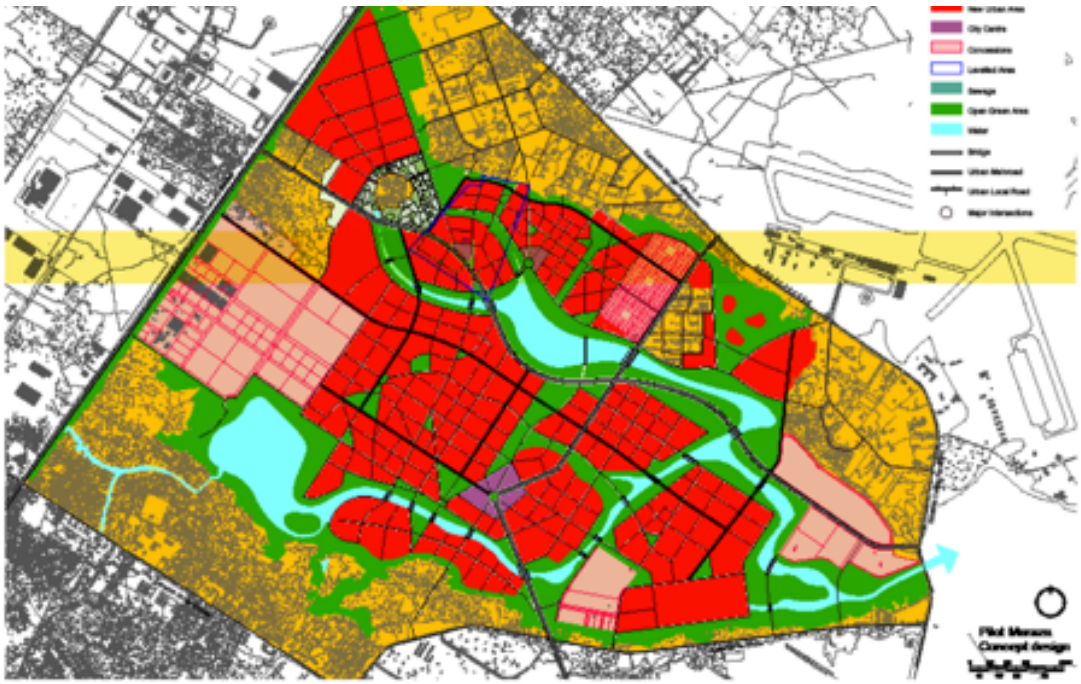


Figure 7.3a Proposed Spatial Layout of Maraza New Town Neighborhood[450]

7.5 Project Identification and Pipelines for Infrastructure and Urban Services

The 2035 Master Plan identifies a range of projects consistent with the recommendations laid out in this report.[451] This section will first identify those projects that are high-priority with respect to public health and safety (water, sanitation, and solid waste management – flood management will be identified in the next section). These projects should be implemented alongside the projects related to land management capacity laid out in section 7.4.

The first is the rehabilitation and expansion of the drinking water grid and associated water treatment works. The 2035 Master Plan estimates that the combined cost of such an initiative would range from EUR 35 million to 60 million. As the plan notes, the revenue model for water is relatively straightforward, as it is largely fee-for-service. The city government of Beira will require assistance in identifying instances in which private sector partnerships are most likely to be both useful and cost-effective.

The city sanitation grid similarly must be both rehabilitated and expanded in a way that is consistent with city development goals. The 2035 Master Plan estimates the cost of this initiative to be between EUR 20 million and 40 million. This report estimates that the possible cost of this initiative could exceed USD 75 million. This sector similarly operates with a fee-for-service revenue model, and so might be well-suited to private sector participation. Additionally, low-cost decentralized methods for sanitation should be explored.

This report estimates that solid waste management service coverage in Beira is already extensive (roughly 75%). However, improper disposal of solid waste via burying, burning, or discarding in drainage ditches is a public health hazard. Uncovered areas are generally informal, unplanned peri-urban areas that are difficult to access. This report estimates the cost of total service coverage to consist of an initial investment in equipment of USD 0.6 million, with follow-on operations and maintenance costs between USD 1.1 million and 2.1 million per year. The revenue model for this sector is fee-for-service.

Other follow-on projects are less critical to public health and safety but will be necessary to integrate and develop the metropolitan area as it expands and facilitate robust growth of the local economy. These include the expansion of the city transportation grid and public transportation services, and the expansion of the city power grid. Cost estimates for each of these projects are outlined in sections 2.2 and 2.3, respectively.

Pilot Project: Drinking Water Provision[452]

The municipal government of Beira (CMB) and the local division of FIPAG have partnered with the Dutch social enterprise Vitens Evides International for the purpose of addressing infrastructural and administrative shortcomings regarding the provision of drinking water in the city. The duration of the contract is from January 2015 to December of 2019, and it is valued at EUR 6.5 million. The objectives of the partnership are to improve access, to improve water quality, to improve service hours, and to improve the financial position of the utility. Its comprehensive plan to achieve these objectives includes: the rehabilitation and update of the pipe network, with a modest extension of 85 kilometers; an expansion in production capacity of 10%; the repair of faulty meters, and the improvement upon collection rates; the improvement of network management, customer support, and technical troubleshooting capabilities. The initiative is financed by the consortium partners and by the RVO Sustainable Water Fund.

We believe that the objectives of this partnership are consistent with the recommendation in this report, and that the partnership represents an easy opportunity for follow-on funding. Vitens Evides International represents a credible partner with the technical and project management expertise necessary to properly co-manage funding alongside the municipal

government and FIPAG. One of the objectives of the partnership is to improve the cost recovery of the enterprise by increasing fee collection rates and improving cost efficiency.
We recommend that the mandate of the partnership expand to include exploring opportunities within the context of infrastructure rehabilitation and expansion to strategically orient existing and new development for easy follow-on development. This should be consistent with the city's overall urban expansion strategy, and this report's recommendation regarding the conversion of unplanned shantytowns into planned neighborhoods.

Expanding the mandate of the Vitens Evides International partnership to integrate with the Maraza New Town project (a prospective new, fully planned, and low-income neighborhood) is an opportunity to implement all of the above recommendations as part of a pilot project that takes a holistic approach to pro-poor urban development in a manner consistent Beira's objective regarding housing, infrastructure, and the environment.

Pilot Project: Sanitation[453]

Initiatives to develop the sanitation sector in Beira currently exist and should be targeted for expansion. This report will specifically highlight the operations of two Dutch organizations, the Frysian Urban Sanitation Project (FUSP) Consortium (which includes contributions from Dutch water company Vitens and the government of the province of Frysland), and WASTE urban development and environmental consultants, which operate in concert with the municipal government of Beira (CMB).

The partnership identifies local businesses that work within or adjacent to the sanitation sector along the entire operational chain, and provides technical training, education in entrepreneurship, support for the development of a business model and connections to local financial institutions. The objective of the partnership is to expand decentralized private-sector solutions to the sanitation service coverage gap. In a city like Beira, where municipal services are severely lacking, these types of private-sector solutions are critical.

However, because of poverty levels in Beira, and because this sector is critical to public health, business models may be more complicated than simple a fee-for-service transaction model between providers and end users. For example, CMB may be involved if it becomes necessary to subsidize services via general tax revenues, or if regulation is necessary. In some instances, a private business, or multiple businesses, may provide sanitation services by contract or concession.

The FUSP and WASTE program partnership notes that financial institutions in Mozambique have little experience with business models in the sanitation sector and lack the requisite technical knowledge to evaluate the financial sustainability of operations and services. Consequently, financial support for this initiative has been insufficient. We recommend increasing funding through this program for the following purposes: to conduct further market and cost recovery analysis; to further support the identification and formulation of viable business models (including PPPs) and product offerings in this sector; and to bolster financial support for operations.

Pilot Project: Solid Waste Management

The sources cited in this report estimate that the municipal government of Beira already successfully manages seventy-five percent of the city's solid waste. Additionally, we estimate that the capital expenditure, and annual operations and management necessary to meet residual demand to be a small amount relatively to the financial need in other sectors. Because the financing gap is relatively small, and the city has the institutional capability to handle service provision, we recommend that funding in this sector be dedicated to expanding the capacity of the municipal solid waste management services via loans disbursed to the municipal government.

However, there are other options for follow-on development in this sector that can take place via small business loans disbursed via the FUSP/WASTE partnership detailed in the previous section that might serve to supplement the city's waste management capability and assist in cost recovery by means other than service fees. This report identifies three areas of focus for donor funding.

The first regards the expansion of solid waste collection services into the informal and difficult-to-access areas of Beira. This will reduce improper disposal of solid waste in ways that are environmentally unfriendly, including burying and burning. It will additionally reduce the amount of solid waste that is discarded in drainage ditches, which impedes their function and contributes to flooding.

The second involves identifying and implementing business models that make use of recyclable materials. In course of this analysis we identify three possible product offerings of interest: fuel briquettes made from organic waste; building materials made from recycled plastics; and compost made from recycled organic waste. Local business Terra Nova has already implemented a successful business model as a compost producer. However, much of Beira's organic waste goes unused, and there is likely unmet market demand for products used in agricultural production.

The third involves landfill management. In addition to a growing need for environmentally friendly landfill management services, there is also an opportunity in this sector to siphon off decomposition byproduct methane for use as an energy source.

Initiatives that result in finished products made from recycled materials may present an opportunity to reduce the city's environmental impact, assist in cost recovery in the solid waste management sector, and in the case of recycled metals and plastics, contribute to the development of a low-cost modular housing template.

7.6 Project Identification and Pipelines for Resilient and Green Urban Development Projects

It should be noted that the pipeline projects elaborated in sections 7.4 and 7.5 indirectly address the resilience of Beira to climate change-related extreme weather events. This includes projects that address shortcomings in water and sanitation services, and in land management capacity.
There is a long list of opportunities in the public and private sectors, and at the household level to apply green technologies to development, and to incentivize the changing of behaviors considered "not green" that via policy and the provision of alternative options.

Households

At the household level, opportunities to apply green technologies include the use of green building materials. Previously, this report discussed home-building materials constructed from recycled plastic pressed into interlocking bricks. This type of building material would have several advantages: it is inexpensive; it reduces the quantity of solid waste in landfills; it provides a revenue stream for the solid waste management utility or presents an opportunity for private enterprise; and it is suitable for self-construction.

Improper human waste disposal makes contamination of drinking water likely, especially after rain and flooding. Decentralized sanitation management might prevent the spread of water borne diseases in the interim should full extension of the sanitation grid prove to be too costly or difficult in certain areas. Options to address this problem include condominium or separated modern latrines.

The use of non-potable water is problematic with respect to public health, even absent direct contamination by human waste. In the event that full extension of the water grid proves to be too costly or difficult in certain areas, decentralized provision solutions can

be implemented at the household level. These solutions include: filtration systems; rainwater capture systems; and greywater recycling systems.

Finally, the use of trash or other inefficient energy sources for heat and cooking is prevalent amongst poor households. Decentralized solutions for meeting demand for energy include: neighborhood-level solar energy systems, and the use of recycled organic waste to make fuel briquettes. Although most of Beira's grid-provided energy is produced via hydroelectric dams, Solar energy systems might be useful in areas to which it is difficult or cost-ineffective to extend grid infrastructure. Fuel briquettes would provide another revenue stream for the solid waste management utility (or a private entity) and would recycle organic waste into a less-polluting energy source relative to trash.

Private Sector

As has been noted, there are a number of business opportunities in Beira in areas adjacent to municipal services. This includes opportunities to supplement municipal waste management services, to capture landfill methane, and to repurpose recyclable materials to create household products, recycled building materials, fuel briquettes, and compost. A model for green business in Beira is compost producer Terra Nova, which profitably converts a small proportion of Beira's organic waste into soil that is sold to farmers.

Additionally, the transportation sector in Beira consists of small and informal operators. There are currently no restrictions placed vehicle safety, or fuel efficiency. Policy options to create "green" outcomes in this sector include better route management to reduce traffic and reduce GHG emissions; mandating fuel efficiency and vehicle inspection standards. Technological solutions include experimenting with the application of electricity- and biofuel-powered vehicles. Because no large mass transit entities currently exist in this sector, the path forward in is relatively clear of sunk infrastructure costs or special interests.

Public Sector

Previously identified opportunities to become involved in the conversion of recyclable materials into usable products might be conceded to private sector entities or might alternatively be used by the city as method for generating new revenue streams for public utilities.
Additionally, strategic planning, which is a capability that has been lacking in particular at the municipal level, could serve to direct development spatially in such a way that it minimizes the exposure of both people and infrastructure to natural disasters, and also provides guidance for development that minimizes the damage done to the environment as a result of development.

Similarly, engineering and construction standards that regulate construction materials and methods can also serve the aforementioned objectives of environmental protection and safety.

Flood Management

Additionally, the ability to properly manage storm water remains a major concern. Projects number seven and eight of the 2035 Master Plan eight involve measures to improve coastal protection and drainage. The plan estimates the combined cost of these initiatives between EUR 74 million to 100 million. This report cites cost estimates that the full range of necessary improvements might exceed USD 350 million. It is difficult to generate revenues from these types of infrastructure investments; possible sources of revenue that might partially offset initial expenditures include mandatory insurance premiums, or development schemes that combine flood management infrastructure with other types of commercial and residential development. However, the city should consider whether it can reduce the amount of necessary expenditure on drainage and coastal protection infrastructure in the long run by pivoting development to low-hazard areas. The following pilot project addresses this need.

Pilot Project: Drainage[454,455,456]

A joint initiative between the municipal government of Beira (labor and equipment), GIZ (technical support), and KfW (financing) has sought to tackle the issue of poorly-functioning tertiary drainage infrastructure in the Goto neighborhood of the Ponte Gea district, which is located on the southern coast of the peninsula. The project sought to rehabilitate drainage ditches in the neighborhood via community mobilization model that made use of local labor and equipment contracted through the municipal government. The partnership provided on-the-job technical training to laborers, as well as community education regarding proper maintenance of drainage infrastructure. The total cost of this project in Goto was roughly EUR 147,000.

The above was part of a larger initiative to rehabilitate tertiary drainage infrastructure that was successfully scaled and implemented in Beach Zone New, Chipangara, Chota, Goto, Inhamizua, Macurungo, Manga, Matacuane, Maraza, and Munhava, and successfully cleared an estimated 50 percent of obstructions.

We recommend that donor funding be allocated to continue this initiative to clean and rehabilitate drainage infrastructure, with a particular focus being paid to at-risk informal settlements on the coast. We additionally recommend that these initiatives adhere to the guiding principles of environmental sustainability laid out in the "Greeninfra 4 Beira" report, which recommended that constructed drainage infrastructure be built to accommodate the natural terrain and its elevation so as to minimize the environmental impact of development, and that it also exploit the capacity of natural waterways to carry away stormwater. We finally recommend that the initiative be extended to the Maraza New Town pilot project.

While the tertiary drainage rehabilitation project is relatively inexpensive to finance, as evidenced by the case of Goto, cost recovery cannot be achieved by direct means.

END NOTES

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Chapter 8

Conclusions

Mozambique is one of the least developed countries in the world. It is also one of the most exposed to the consequences of climate change, thanks to its poverty, and its geography, which includes nearly 3,000 km of ocean coastline. Because of pervasive underdevelopment and a heavy reliance on natural resource sectors for economic prosperity, Instances of extreme storms, flooding, and drought threaten both economic stability and human development. It is estimated that inaction with respect to climate change will cost Mozambique roughly USD 400 million annually starting sometime within the next several decades; last year, this would have been nearly 3% of GDP.

These development and climate exposure issues are additionally compounded by high rates of urbanization in low-lying coastal cities. Urban growth trends took off during Mozambique's civil war as citizens fled violence, and continue during the present day as many poor Mozambicans seek out new economic opportunities. However, these trends also create concentrated and multi-dimensional poverty, and concentrated exposure to climate change-related hazards.

Nowhere in Mozambique are these problems better exemplified than in the port city of Beira, which is Mozambique's second largest city with approximately 600,000 inhabitants. By the year 2035, Beira's population is expected to grow to between 827,000 and 1,422,000 residents, threatening to make even more severe its already dire need for better climate resilience, municipal services and housing. Currently in Beira, we estimate that 40 percent of the city lives in flood zones; 70 percent lives in housing that is substandard in at least one major aspect of construction; 25 percent do not have access to solid waste management services; 60 percent do not have regular access to quality energy sources; 45 percent (and likely more) do not have access to a consistent and quality source of water; and an estimated 45 percent dispose of human waste in a way poses a threat to public health.

Beira's risk exposure to extreme weather events is estimated at 20% of the city's fixed capital asset value (or roughly USD 580 million). For Beira, a 2012 INGC report estimated expected economic loss due to climate change at somewhere between USD 20 million to USD 185 million within the next two decades, and warned that outlier events might be significantly more damaging. The last major weather event to hit Beira at the time of that report was a cyclone in 2000 that displaced 20,000 people and caused USD 60 million worth of asset damage. Beira currently does not make use of any risk transfer mechanisms to insure economic loss due to climate change-related events.

The authors of this report estimate that the current financing gap in housing amounts to roughly USD 435 million, with Beira's poorest residents being the demographic primarily affected by the housing shortage. By 2035, the financing gap in the housing sector is expected to rise by an additional USD 370 to 2,257 million (based on a per-unit cost range of USD 9,000 to 55,000 if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 1.38 to 8.4 billion if urbanization follows high growth rate estimates (4.25%).
The financing gap as it regards maintenance for Beira's existing road network is estimated at USD 14 million at present, with the average annual recurring cost for maintenance at USD 5.8 million.

The cost estimate for updating this network such that all roads are paved and of climate-robust construction is USD 225 million (with an associated average annual recurring maintenance cost of USD 12 million). Extending Beira's road network to cover 80 percent of the metropolitan area and maintain spatial density would require an additional USD 71 million in construction costs and an additional USD 4 million in maintenance costs per year. With respect to rolling stock, the financing required to provide full public transit coverage to city of Beira is estimated at USD 49 million in fixed capital assets, and USD 46 to 74 million

annually for operations and maintenance. By 2035, the financing requirements for rolling stock are expected to rise by an additional USD 66 million (fixed capital assets) and USD 62 to 100 million (operations and maintenance) if urbanization follows low growth rate estimates (2.25% annually); or by as much as USD 113.8 million (fixed capital assets) and USD 107 to 171 million (operations and maintenance) if urbanization follows high growth rate estimates (4.25%).

In the energy sector, the cost estimate for meeting the current demand gap via expansion of the power grid is USD 57.3 million; By 2035, the financing requirements for grid extension are expected to rise by an additional USD 32.8 million if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 122.6 million if urbanization follows high growth rate estimates (4.25%). Although Mozambique's power sector is being developed rapidly due to investor interest, these high-growth estimates would likely send Beira's power consumption soaring to 7% of the current national total. Much of Beira's energy is already green hydropower, and the city has the opportunity to build upon this record of environmental friendliness by seeking to implement other alternative and green energy sources that are abundantly available in Mozambique, such as natural gas and solar energy.

With regards to drinking water supply, the cost of meeting the current demand gap via expansion of the water grid is estimated at USD 4 million; by 2035, the financing gap for these water grid connections is estimated to grow by an additional USD 3 million if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 10.7 million if urbanization follows high growth rate estimates (4.25%). We further estimate that the current treatment works must expand to 171 percent their current capacity to meet the current demand gap, and to between 221 to 356 percent each of the previous urbanization scenarios. Beira has the opportunity moving forward to try to diversify and strengthen its drinking water supply by exploring the application of segmented networks, building new reservoirs, and building drinking water distribution centers in key under-served areas where installing household connections would be impossible or inappropriate from a strategic urban planning standpoint.

In the sanitation sector, the cost of supplying environmentally safe latrines to non-served populations is estimated USD 15 million at present; by 2035, the financing gap for these latrines would be estimated to grow by an additional USD 12.3 million if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 46 million if urbanization follows high growth rate estimates (4.25%). The cost of supplying sewer or septic system connections to non-served populations is estimated USD 77.6 million at present; by 2035, the financing gap for these solutions would be estimated to grow by an additional USD 33.5 million if urbanization follows low growth rate estimates (2.25% annually), or by as much as USD 125 million if urbanization follows high growth rate estimates (4.25%).

Should these solutions be implemented, meeting the current demand gap would require the municipal waste treatment capability to expand to as much as 194 to 335 percent its current size (based on estimates of low and high per capita waste generation rates) ; to meet each of the 2035 urbanization scenarios, the treatment works would need to increase to between 263 to 455 percent their current capacity (low-growth scenario), or to between 452 to 783 percent their current capacity, respectively. The government may be able to cut down costs and reduce the spatial imprint of sanitation-related infrastructure by building condominium facilities. Green solutions in this sector include household greywater systems, and UV wastewater treatment. There are additionally opportunities in this sector for private sector septic system services, like those in neighboring Tanzania mentioned in this report.

In the solid waste management sector, Beira already successfully manages 75 percent of the solid waste generated in the city. Covering the rest would require roughly USD 0.6 million in fixed capital investment, and USD 1.1-2.1 million (based on variable waste generation rates) in annual operations and maintenance costs. In 2035, these financing requirements are estimated to increase by an additional USD 1.8 million (fixed capital investment) and a total operations and maintenance financing requirement of approximately USD 2.9 million annually (for a low urbanization rate); or by an additional USD 4.5 million (fixed capital investment) with a total operations and maintenance requirement of USD 5.1 million per year. Opportunities in this sector for the application of green technologies and for private sector business growth are plentiful, and include landfill methane capture, using organic waste to produce compost and fuel briquettes, and using recyclable inorganic waste to produce building materials and household products. A successful business model in this sector is illustrated by local compost producer Terra Nova.

With respect to governance, shortcomings in administrative capacity threaten to inhibit development progress. Broadly speaking, the municipal government lacks a sophisticated ability to monitor and manage data related to the condition and performance of its various bureaucracies and assets, to include public infrastructure. For example, a recent partnership with Vitens Evides International revealed that the city lacks an accurate map of its water grip. Another shortcoming that is extremely detrimental to urban development in Beira is a lack of any real ability to monitor land usage and enforce regulation, which has led to the growth of massive informal settlements in low lying coastal areas that inhibit construction and pose large public health risks. Shortcomings in administration and land management also degrade the ability of the government to collect taxes, leading to sub-optimal revenue collection rates which in turn threatens the solvency of public utilities and prevents expansion to underserved populations.

Despite these serious challenges, prospects for success in Mozambique, and in Beira are generally positive. The real annual growth rate of the economy has been consistently estimated at around 7 percent for the past several years, and Mozambique's underexploited natural resources present lucrative opportunities to reinforce growth. Additionally, Mozambique has no entrenched, environmentally unfriendly habits it will need to break over the course of development. It is one of the lowest greenhouse gas emitters in the world, and has already begun to build key sectors, such as the energy sector, around green and renewable resources (in this case, hydropower). Additionally, Mozambique has the advantage of already having principles of resilience and environmental sustainability enshrined in national policy and can rely on these institutionalized principles to guide its development efforts.

Finally, financial sector underdevelopment is frequently an impediment to the growth of businesses or the establishment of projects catering to Mozambique's low-income citizens. Real estate developers and Mozambican financial institutions cater mostly to financially stable business and individual clients, with quality credit history and assets that can be used as collateral, making it difficult for small and medium enterprises, and low-income families to obtain loans for business development or home ownership. In the realm of infrastructure- and services- related investment outside of lucrative natural resource sectors, the prospect of failure to recover costs blunts investor interest. Additionally, little to no financial support from government for low-income households seeking to obtain loans ensures that there is little incentive for private sector actors to cater to this demographic.

In Mozambique generally, and in Beira specifically, it is easy to become overwhelmed by the sheer volume of financing/financial market, institutional, and infrastructure development that is apparently necessary to close demand gaps across sectors. However, the key considerations laid out in this report should allow Beira to approach development

in a methodical and sustainable manner. We summarize those considerations here.

First, information management and administrative capacity is key to any effort to establish mechanisms that ensure accountability and the efficient use of public money. Development initiatives should be transparent, and determinations of success should be based on evidence.

Second, all development projects should be ultimately accountable to national and local development objectives regarding alleviation of poverty, resiliency, and environmental sustainability. These objectives should shape development, not the reverse.

Third, projects should be chosen based on clearly defined set of priorities, which, in addition to the above, should seek to determine whether a project is critical to public health and safety, whether a project requires complementary development in other sectors to be successful, and whether it is financially sustainable.

Fourth, all the above criteria should be enshrined in strategic master plan, so that urban development is conceptualized and implemented in a holistic manner.

Fifth, community feedback regarding broad city development goals and project selection is an essential part of successful development. Market support for development is essential to financial sustainability. The national government and local governments cannot consistently spend in deficit and rely on grants and transfers to meet financial obligations.

Sixth, a successful approach to financing will include an integrated effort on the part of international development institutions, government, and private sector partners. Mozambique has learned to successfully manage grant money but has not learned to properly manage PPPs or support the growth of private markets. International development institutions have experience securing finance and implementing partnerships across sectors; they must communicate these things effectively to local stakeholders. The Government of Mozambique must invest in institutional capacity (both administrative, and institutional learning); must capitalize upon its unique ability to understand local contexts and to identify opportunities for private enterprise; and must support those opportunities via policy. Private sector partners must be willing to communicate analysis of the national business environment to the Mozambican government and must be willing to move beyond easy opportunities in energy and commodities to explore opportunities to develop Mozambique's economy and financial sector.

APPENDIX A: Mozambique National Financial Statistics and Macroeconomic Indicators[457]

Macroeconomic Indicators for Mozambique (Currcnt Prices**)**

	2010	2011	2012	2013	2014	201S	Units	Data Source	Notes
GDP Data (local currency, current prices):									"...." = No Data
Household Consumption Expenditure	268348	289576	337190	363123	372,134	399.138	MZN Millions	2017 IFS Yearbook	
Government Consumption Expenditure	64131	76137	90282	115101	138592	157827	MZN Millions	2017 IFS Yearbook	
Gross Fixed Capital formation	61599	82232	152145	189791	228937	182811	MZN Millions	2017 IFS Yearbook	
Changes in Inventories	1491	15738	53076	72875	65469	67320	MZN Millions	2017 IFS Yearbook	
Exports	108659	127587	140228	146451	177397	187559	MZN Millions	2017 IFS Yearbook	
Imports	159389	209578	339800	405108	450752	402631	MZN Millions	2017 IFS Yearbook	
GDP	344839	381692	433122	482233	531777	592024	MZN Millions	2017 IFS Yearbook	
GDP (Nominal Growth)		11%	13%	11%	10%	11%	% per Annum	Calculated	
GDP (Real Growth)		7.12%	7.20%	7.14%	7.35%	6.75%	% per Annum	Calculated	
GDP Deflator (Mozambique)	100	103.33	109.38	113.67	116.66	121.77	Imlcx	World Bank Data	2010 Base Year
GDP Deflator (United States)	100	102.1	103.9	105.6	107.5	108.7	Index	2017 IFS Yearbook	2010 Base Year
International Liquidity:									
Total Reserves Minus Gold	2.159.39	2.468.77	2.770.24	3.142.33	3.009.98	2.411.42	USD Millions	2017 IFS Yearbook	End of Period
SDR Holdings	167.07	165.05	162.98	160.3	147.74	109.3	USD Millions	2017 IFS Yearbook	End of Period
Reserve Position in the Fund	0.01	0.01	0.01	0.01	0.04	0.04	USD Millions	2017 IFS Yearbook	End of Period
Foreign Exchange	1,992.32	2.303.71	2.607.25	2.982.02	2.862.20	2.302.08	USD Millions	2017 IFS Yearbook	End of Period
Gold (National Valuation)	106.25	125.26	191.29	209.91	209.81	170.22	USD Millions	2017 IFS Yearbook	End of Period
Central Bank: Other Assets	7.09	21.26	31.51	34.78	10.33	4.02	USD Millions	2017 IFS Yearbook	End of Period
Central Bank: Other Liabilities	4.78	12.15	19.62	26.65	31.83	78.04	USD Millions	2017 IFS Yearbook	End of Period

Other Depository Corps: Assets	1010.44	960.31	1212.86	1139.11	1056.42	1087.82	USD Millions	2017 IFS Yearbook	End of Period
Other Depository Corps: Liabilities	311.61	369.7	498.56	664.48	661.32	574.6	USD Millions	2017 IFS Yearbook	End of Period
Central Bank:									
Net Foreign Assets	57.107.50	56.869.40	73.083.10	85.683.10	91.486.00	91.740.90	MZN Millions	2017 IFS Yearbook	End of Period
Net Claims on Central Government	-20.611.7	-26.756.7	-27.543.6	-45.685.2	-50.966.7	-31.567.7	MZN Millions	2017 IFS Yearbook	End of Period
Claims on Other Depository Corps	510.60	358.10	493.80	74.60	77.50	1.738.20	MZN Millions	2017 IFS Yearbook	End of Period
Claims on Other Sectors	510.80	930.30	1.341.20	1.332.10	1.680.60	1.696.70	MZN Millions	2017 IFS Yearbook	End of Period
Other Liabs. To Other Depository Corps.	74.40	4.199.20	13.173.70	10.082.70	4,435.80	8.998.10	MZN Millions	2017 IFS Yearbook	End of Period
Monetary Base	31.618.30	34.311.10	41.086.00	47.537.80	57.283.20	73.907.70	MZN Millions	2017 IFS Yearbook	End of Period
Currency in Circulation	20.446.60	21.898.70	26.242.20	30.351.10	36.316.00	39.334.50	MZN Millions	2017 IFS Yearbook	End of Period
Liabs. To Other Depository Corps.	11,171.70	12.412.40	14.843.80	17.186.70	20.967.30	34.573.30	MZN Millions	2017 IFS Yearbook	End of Period
Shares and Other Equity	7,295.70	-5.449.4	—4.982.9	-15,138.3	-13.236.6	-2.434.5	MZN Millions	2017 IFS Yearbook	End of Period
Other Items (Net)	-2.207.6	-2.710.7	-2,997.6	-2.394.3	-7.815.1	-18.804.0	MZN Millions	2017 IFS Yearbook	End of Period
Total Assets	78.300.00	340.498.70	420.906.80	500.516.80	570.678.90	634,046.90	MZN Millions	2017 IFS Yearbook	End of Period
Monetary Data:									
Base Money	31618.3	34311.1	41086	47537.8	57283.2	73907.7	MZN Millions	2017 IFS Yearbook	End of Period
Ml	89193.3	97578.4	129196.1	146021	181601.8	218393.9	MZN Millions	2017 IFS Yearbook	End of Period
Broad Money	133411.8	143801.7	186013	216424.9	264469.8	333464.6	MZN Millions	2017 IFS Yearbook	End of Period

APPENDIX B Mozambique Balance of Payments Data[458]

Balance of Payments of Mozambique (USD Millions, Current) ***IMPORTANT: Except for the last line item below this table follows the BPM6 FORMAT***						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Current Account						
Goods, exports	2,333.30	3,118.30	3,855.50	4,122.60	3,916.40	3,413.30
Goods, imports	3,512.40	5,367.60	7,903.10	8,479.50	7,951.70	7,576.60
Balance on goods	**–1,179.2**	**–2,249.3**	**–4,047.5**	**–4,356.9**	**–4,035.3**	**–4,163.3**
Services, exports	244.90	366.00	792.10	645.50	724.90	722.60
Services, imports	1,213.70	2,250.60	4,497.80	3,904.30	3,657.10	3,029.0
Balance on goods and services	**–2,148.0**	**–4,133.9**	**–7,753.2**	**–7,615.7**	**–6,967.5**	**–6,469.7**
Primary Income, credit	134.80	184.00	133.10	134.30	128.00	112.50
Primary Income, debit	494.00	383.10	208.50	192.90	329.90	412.6
Secondary income, credit	861.60	1,041.70	1,109.20	1,506.00	1,497.10	938.3
Secondary income, debit	33.70	37.50	70.50	85.20	124.80	136.3
Balance on Current Account (CA)	**–1,679.4**	**–3,328.9**	**–6,790.0**	**–6,253.4**	**–5,797.1**	**–5,967.9**
Capital Account, net (KA)	**354.90**	**445.60**	**489.60**	**422.80**	**374.90**	**287.80**
Financial Account:						
Direct investment, assets	237.90	83.60	8.90	522.30	97.00	1.50
Direct investment, liabilities	1,258.50	3,663.90	5,635.10	6,697.40	4,998.80	3,868.4
Portfolio investment, assets	0.30	33.70	22.00	56.50	–6.5	–17.5
Portfolio investment, liabilities	0.80	.. ..	.. ..	798.20	9.60	–66.9
Financial derivatives, net	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
Other investment, assets	–48.0	567.70	–27.8	1,856.60	1,653.90	189.6
Other investment, liabilities	401.60	157.40	1,013.60	1,144.10	2,019.9	1,347.9
Balance on Financial Account (FA)	–1,470.8	–3,136.3	–6,645.7	–6,204.4	–5,238.8	–4,975.7
Net Errors and Omissions (ERR)	**54.80**	**–9.4**	**32.10**	**22.40**	**31.1**	**25.0**
Reserves and Related Items (BOP)	**201.10**	**243.70**	**377.40**	**396.10**	**-107.30**	**-679.4**
Official Reserve Transactions (ORT)	**-201.10**	**-243.70**	**-377.40**	**-396.10**	**107.30**	**681.40**

Project Name	Activity Name	Approximate Cost (EUROS)	Description of Activity	Description of Finance model
Beira 2035 Master Plan	1 - Institutional Capacity Building	1,100,000	Development of integrated urban development plan; laying foundation for effective implementation.	Combine capacity-building and infrastructure project funding; seek debt financing from IFIs; OR Request funding specifically for the purpose improving institutional capability; solicit funds from IFI grant programs, bilateral development partners.
Beira 2035 Master Plan	2- Study: Dredging Port Access Channel	500,000	Study undertaken regarding the reduction of operating and maintenance costs of the port, to improve competitive position.	CMB should consider financing in conjunction with CFM (national port authority); It may be that IFI interest in financing the study can be solicited in the event that the study leads to a future opportunity to finance new technical capabilities or infrastructure; Sovereign development funds/ institutions.
Beira 2035 Master Plan	3a - Urban Transport Plan	500,000	Development of a policy framework for addressing issues related to public transportation and infrastructure	It may be that IFI interest in financing the study can be solicited in the event that the study leads to a future opportunity to finance new technical capabilities or infrastructure.
Beira 2035 Master Plan	3b - Rehab / Paving of Primary Acess Roads	TBD	Improving accessibility of Beira's central zones	Existing general public funds, or new economic instrument to generate funds earmarked for road rehabilitation; Study necessary to determine feasibility of private sector financed and operated toll road (i.e. BOT concession).
Beira 2035 Master Plan	3c - Rehab of Hinterland Road / Rail Infrastructure	TBD	Improving the accessibility of Beira's peripheral zones, pursuing better integration of central and peripheral zones.	Study necessary to determine feasibility of private sector- or IFI- financed and privately operated toll road (i.e. BOT concession).

Beira 2035 Master Plan	3d – Urban Public Transportation System	200,000	Study regarding the expansion of public transportation services, with a particular focus on improving the mobility of low-income residents.	Multilateral financial institutions typically are amenable to financing such projects; Development plan for public transportation services must be derived from a larger strategic plan regarding public transportation infrastructure.
Beira 2035 Master Plan	3e - New Port Access Road	100,000,000	Improvement of road access to Beira City/ Port of Beira; part of future urban road network	Study necessary to determine feasibility of private sector- or IFI- financed and privately operated toll road (i.e. BOT concession); Alternatively, CMB/CFM may solicit private financing if government can identify a dedicated revenue stream sufficient for debt service.
Beira 2035 Master Plan	3f - Rail Extension to Port	45,000,000	Improved rail access to the Port of Beira	Study necessary to determine feasibility of private sector- or IFI- financed and privately operated rail service (i.e. BOT concession), or to justify a Public-Private Partnership; Alternatively, CMB/CFM may solicit private financing if government can identify a dedicated revenue stream sufficient for debt service.
Beira 2035 Master Plan	3g - Rehab of EN6 Main Acess Road	TBD	Improve access to Beira, increase safety	Study necessary to determine feasibility of private sector- or IFI- financed and privately operated toll road (i.e. BOT concession); The highway in question is the responsibility of the federal government, not the city.
Beira 2035 Master Plan	4 - Rehab / Expansion of Water Treatment lant	20,000,000	Improve quality capacity of water treatment systems in order to reinforce sustainable city growth	Because water service provision implies an associated revenue stream, it may be possible to find private sector partners interested in PPPs, or in involvement at any of the infrastructure building, infrastructure management, or service provision stages.
Beira 2035 Master Plan	5 - Rehab / Expansion of Water Distribution Network	40,000,000	Improve quality capacity of water distribution systems in order to reinforce sustainable city growth	Because water service provision implies an associated revenue stream, it may be possible to find private sector partners interested in PPPs, or in involvement at any of the infrastructure building, infrastructure management, or service provision stages.

Beira 2035 Master Plan	6 - Rehab / Expansion of Sewer Network	40,000,000	Improvement and expansion of sewer network; improve upon waste treatment systems. Part of effort to address public health concerns	Because sanitation service provision implies an associated revenue stream, it may be possible to find private sector partners interested in PPPs, or in involvement at any of the infrastructure building, infrastructure management, or service provision stages. ** The data referenced in this study have indicated that revenue streams earmarked for sanitation services in Beira are not substantial; There do currently exist small scale service providers in this market, though we do not have information on their size or the exact nature of services provided.**
Beira 2035 Master Plan	7 - Coastal Protection	USD 10,000,000	Measures to improve resilience to climate change-related events	Government and development partners are most likely sources of funding, as it is unclear how the city might derive revenue streams directly from climate change resilience-related infrastructure; Flood or storm damage insurance schemes may induce households, businesses, and insurers to contribute to broad investment in climate change resilience measures.
Beira 2035 Master Plan	8 - Drainage	90,000,000	Measures to improve resilience to climate change-related events	Government and development partners are most likely sources of funding, as it is unclear how the city might derive revenue streams directly from climate change resilience-related infrastructure; Flood or storm damage insurance schemes may induce households, businesses, and insurers to contribute to broad investment in climate change resilience measures.
Beira 2035 Master Plan	9 - Social Housing	200,000	Study to evaluate possible solutions to low-income housing shortage	Government and development partners are most likely sources of funding, as rents are typically below market levels, and thus require subsidies.

Beira 2035 Master Plan	10 - Partial Area Structure / Zoning Plans	1,000,000	Elaboration of broad development strategies laid out in 2035 Master Plan	It may be that IFI interest in financing the study can be solicited in the event that the study leads to a future opportunity to finance new technical capabilities or infrastructure.
Beira 2035 Master Plan	11 - Land Development Company	TBD	Establishment of entity responsible for provision of commercial/residential plots which are climate-resilient and tied to municipal utility infrastructure	Requires additional study, elaboration
Beira 2035 Master Plan	12 - Solid Waste Management	TBD		Because waste management service provision implies an associated revenue stream, it may be possible to find private sector partners interested in PPPs, or in involvement at any of the infrastructure building, infrastructure management, or service provision stages; There do currently exist private service providers either directly in or peripheral to this market. They are elaborated in section 2.5.6.
Beira Green Infra Master Plan	Not started		Pipeline	
Beira Climate Change Action Plan	Not started		Pipeline	
Beira-Mazara New Town Plan	Not started		Pipeline	

APPENDIX C Sample of Previous Local Development Projects

Org. Name	Fund Name	Org. Type	Project Name	Activity	Value (USD)	Value (EUROS)	Funding Type	Status	Start Year	End Year
AfDB	PPCR		Baixo Limpopo Irrigation and Climate Resilience Project	Infrastructure development: marketing infrastructure and agro processing, climate resilient irrigation infrastructure, and climate-proofed rural roads; Capacity building and farm diversification; Support for project management	15,750,000		Grant/Loan	Approved	2012	
Loan	Approved	2012		Forestry Development	200,000		Grant	Approved	2014	
AfDB	PPCR		Sustainable Land & Water Resources Management	Objective of project is to strengthen capacity of communities to address inter-linked challenges of adverse impacts of climate change, rural poverty, food insecurity	15,750,000		Grant/	Approved	2014	
AFD		Donor	Municipal Bond Study		-	-	-	-	-	-
DANIDA	Global Climate Change Alliance		Mainstreaming of Climate Change into policies and strategies to adapt to climate change impacts		17,040,000		Grant	Approved	2010	2015
				Change impacts						
EU		Donor	Beira - Sanitation System		75,000,000	-	-	-	-	2011

EU		Donor	Beira - Dondo Water Treatment Plant		6,250,000	-	-	-	-	2011
FAO	Least Developed Country Fund		Strengthening Capacities of Agricultural Producers to Cope with Climate Change for Increased Food Security through the Farmers Field School	To enhance the capacity of Mozambique's agricultural and pastoral sectors to cope with climate change, by upscaling farmers adoption of CCA technologies and practices through a network of already established Farmers Field Schools, and by mainstreaming Climate Change Adaptation (CCA) concerns and strategies into on-going agricultural development initiatives and mainstreaming CCA issues into agricultural policies and programming.	9,200,000		Grant	Approved	2013	
GEF	Strategic Priority on Adaptation		Zambezi Valley Market-Led Smallholder Development		1,689,000	-	Grant	-	-	-
GIZ		Donor	Adaptation to Climate Change		-	-	-	-	-	-
GIZ		Donor	Good Financial Governance		-	-	-	-	-	-
GIZ		Donor	Climate Finance Readiness Program	Not started	-	-	-	Pipeline	-	-

IBRD	PPCR	Climate Change Technical Assistance Project	Objective is to strengthen the institutional and technical capacity of the Government of Mozambique to mainstream climate change resilience into key economic sectors through: policy and institutional reform; KM and evidence building; SPCR management and coordination	2,000,000	Grant	Approved	2012
IBRD	PPCR	Climate Resilience: Transforming Hydro-Meteorological Services	To strengthen hydrological and meteorological information services to deliver reliable and timely information that increases climate resilience, in turn lowering water and weather-related risks to local communities and economic development.	15,000,000	Grant	Approved	2013
IBRD	PPCR	Design of National Strategic Programs for climate Resilience		1,500,000	Grant		
IBRD	Forest Carbon Partnership Facility	Readiness Preparation Grant	To support Mozambique to be ready for REDD+ Implementation, including development of necessary capacity at sub national levels	8,800,000	Grant	Approved	2013
IFAD	Adaptation for Smallholder Agricultural Programme	Pro-poor Value Chain Project in the Maputo and Limpopo Corridors	Climate change adaptation in value chains for irrigated horticulture, cassava and red meat; improved water management and irrigation; strengthening of the weather station network; community based natural resource management plans; pest & disease monitoring	5,000,000	Grant	Approved	2012

IFC	PPCR		Building Resilience of Mozambique's Power Sector Through Private Sector Investment		10,430,000		Grant/			
Loan	Approved	2016								
IFC	Forest Investment Program		Emission Reductions in the Forest Sector Through Planted Forests with Major Investors		1,850,000		Grant	Approved	2017	
IFC	PPCR		Smallholder Irrigation Feasibility Project		575,000		Grant	Approved	2015	
IFC		IFI	Water Supply Credit Line		-	-	-	-	-	-
KFW		IFI	Rio Chveve Rehabilitation	MASTER	14,265,416	-	-	-	-	-
KFW		IFI	Rio Chveve Rehabilitation	C1. Rehablitation of Rio Chiveve	4,801,563	-	-	-	-	-
KFW		IFI	Rio Chveve Rehabilitation	C2. New Sea Outllet	7,783,470	-	-	-	-	-
KFW		IFI	Tertiary Drainage		-	-	-	-	-	-
MDG	Achievement Fund		Environment Mainstreaming and Adaptation to Climate Change		7,000,000		Grant			

			to Climate Change							
NDF		Donor	Waste Transfer and Recylcing Centers		-	1,055,021	-	-	2015	-
SDC		Donor	PRODEM	MASTER	26,000,000	-	-	-	2015	2019
SDC		Donor	PRODEM	C-A. Urban management of climate resilience	11,500,000	-	-	-	2015	2019
SDC		Donor	PRODEM	C-B. Financial management	600,000	-	-	-	2015	2019
SDC		Donor	PRODEM	C-C. Governance and stakeholder engagement	3,400,000	-	-	-	2015	2019
UNDP	Least Developed Country Fund		Adaptation in the coastal zones of Mozambique		4,524,000		Grant	Approved	2011	
UNDP	Special Climate Change Fund		Coping with Drought and Climate Change	To develop and pilot a range of coping mechanisms for reducing the vulnerability of farmers and pastoralists to future climate shocks.	960,000		Grant	Approved	2006	
UNDP	Least Developed Country Fund		National Adaptation Programme of Action		200,000		Grant	Approved	2003	
UNEP	Least Developed Country Fund		Mozambique: Building Resilience in the Coastal zone through Ecosystem Based Approaches to Adaptation		6,000,000		Grant			

UNFCC		Donor	Green Climate Fund		-	-	-	-	-	-
UN-HABITAT		Donor	Community Center for RE		158,000	-	-	-	-	2014
UNIDO/ GEF	GEF6		Towards Sustainable Energy for All in Mozambique: Promoting Market-Based Dissemination of Integrated Renewable Energy Systems for Productive Activities in Rural Areas		2,851,000		Grant	Approved	2015	
USAID		Donor	Coastal Cities Adaptation Program		-	-	-	-	-	-
World Bank		IFI	Cities and Climate Change Project - Beira	MASTER	61,900,000	-	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project	C-2a. ID of Key Investment Priorities	-	-	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project	C-2b-a. Comprehensive study on integrated urban water management	200,000	-	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project	C2b-b. Drainage design and supervision	6,300,000	-	Loan	Approved	2012	2017
				Change Project						

World Bank		IFI	Cities and Climate Change Project	C-2b-c.i Rehabilitation works of primary drainage channel	52,300,000	58,600,000	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project	C2b-d.ii Reconstruction of affected community infrastructure and provision of resettlement housing	2,000,000	-	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project	C-2b-e Capacity building support for BASS	900,000	-	Loan	Approved	2012	2017
World Bank		IFI	Cities and Climate Change Project AF	C-2b-f. Natural drainage management	14,750,000	-	Grant/ Loan	Approved	2015	2018
World Bank		IFI	Cities and Climate Change Project AF	C-2b-g. Disaster recovery fund (zero-budget)	-	-	Grant/ Loan	Approved	2015	2018
Word Bank	PPCR		Coastal Cities and Climate Change		15,750,000		Grant/ Loan			
World Bank	Forest Investment Program		Mozambique Dedicated Grant Mechanism for Local Communities	Strengthening the capacity of local communities, community-based and civil society organizations to participate in sustainable forest and land management	385,000		Grant	Approved	2016	
World Bank	Forest Investment Program		Mozambique Forest Investment Project		22,390,000		Grant/ Loan	Approved	2017	
World Bank	PPCR		Roads and Bridges Management and Maintenance Program	To stimulate growth and contribute to poverty reduction through improved road infrastructure, better sector policies, and enhanced roads sector management	15,750,000		Grant/ Loan	Approved	2013	

		Maintenance Program	policies, and enhanced roads sector management
World Bank	IFI	Roads Rehabilitation Project	
World Bank	IFI	Water Sector and Institutional Support Project	

APPENDIX E Breakdown of Foreign Aid by Sector (USD Millions)[461]

Sector	2009	2010	2011	2012	2013	2014	2015
110: I.1. Education, Total	187.45	144.29	85.52	89.45	117.13	66.43	121.50
120: I.2. Health, Total	187.51	111.95	215.36	265.20	118.89	143.48	120.44
130: I.3. Population Policies/ Programmes & Reproductive Health, Total	234.92	196.01	282.46	162.32	319.78	212.66	378.57
140: I.4. Water Supply & Sanitation, Total	39.36	27.04	50.25	110.07	106.77	17.73	25.08
150: I.5. Government & Civil Society, Total	94.53	176.13	59.86	94.34	73.49	211.20	139.62
160: I.6. Other Social Infrastructure & Services, Total	26.47	14.58	19.15	18.28	23.99	17.29	10.83
210: II.1. Transport & Storage, Total	25.71	80.00	31.19	44.59	275.51	68.18	244.15
220: II.2. Communications, Total	49.31	26.13	1.18	0.20	0.16	0.70	0.39
230: II.3. Energy, Total	54.45	129.67	40.94	100.14	77.19	229.27	83.83
240: II.4. Banking & Financial Services, Total	12.38	9.04	3.88	49.62	0.74	5.89	3.87
310: III.1. Agriculture, Forestry, Fishing, Total	119.60	60.35	74.04	90.08	103.87	67.82	56.47
320: III.2. Industry, Mining, Construction, Total	8.16	100.73	29.86	5.52	8.86	17.45	7.36
332: III.3.b. Tourism, Total	0.39	0.26	0.28	2.31	0.86	1.19	0.89
410: IV.1. General Environment Protection, Total	9.07	47.08	20.71	14.16	16.67	36.82	40.45
500: VI. Commodity Aid / General Programme Assistance, Total	546.10	253.17	291.16	154.38	157.95	205.31	23.59
600: VII. Action Relating to Debt, Total	7.27	0.45	0.01	0.01	34.10	..	..
700: VIII. Humanitarian Aid, Total	42.25	12.05	11.92	20.07	9.12	8.50	5.14
730: VIII.2. Reconstruction Relief & Rehabilitation, Total	0.58	0.03	..	3.12	7.37	0.13	..
740: VIII.3. Disaster Prevention & Preparedness, Total	3.10	19.05	1.90	7.36	9.66	2.38	6.46

END NOTES

[457] "2017 International Financial Statistics Yearbook" (International Monetary Fund, 2017).
[458] "2017 International Financial Statistics Yearbook."
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