



CLIMATE
RESILIENT
AND INCLUSIVE
CITIES



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URBAN ANALYSIS REPORT 2020

01

MATARAM

Wahyu Mulyana

Nila Ardhyarini H. Pratiwi



FOREWORD



Addressing the threat of climate change remains a top priority for the European Union (EU). The European Green Deal is a response to these challenges; it aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy with zero net emissions of greenhouse gases by 2050.

Through the Climate Resilient and Inclusive Cities (CRIC) project, the EU and Indonesia are working together to help cities build a resilient and inclusive future. We do so by building partnerships between governments, businesses, local communities and research institutes in Europe, South Asia and Southeast Asia.

Clearly, there are hurdles along the way, especially in the midst of the COVID-19 pandemic. However, our response to this pandemic needs to be a sustainable one, addressing the challenges of climate change as well as economic recovery. Just last month, in Sukabumi City of West Java Province, a flash flood cost lives and forced hundreds of citizens to leave their houses. According to the Indonesian National Disaster Management Agency, Indonesia is about to experience more hydrometeorological disasters due to climate change. The CRIC Urban Analysis Report is a timely reminder that cities cannot delay their sustainable transition.

This Urban Analysis Report for ten Indonesian pilot cities under the CRIC project offers a comprehensive overview of city characteristics, policy gaps and climate-related policies in the cities of Pangkalpinang, Pekanbaru, Bandar Lampung, Cirebon, Banjarmasin, Samarinda, Mataram, Kupang, Gorontalo and Ternate.

The report provides empirical evidence to help cities develop policies and tools to strengthen climate change-affected sectors. I am happy to note the consultations among a wide range of stakeholders including government officials, academicians, civil society, professional practitioners, NGOs, and the private sector, ensuring that the proposals are inclusive.

We look forward to seeing how the cities will take up the given recommendations by transforming them into local climate-proof policies and programmes and to further working together to build climate resilient and inclusive cities.

Jakarta, October 2020

Vincent Picket

EU Ambassador to Indonesia and Brunei Darussalam

Mayor's Foreword



Mataram is one of ten pilot cities where the Climate Resilient and Inclusive Cities (CRIC) Project is implemented. As a city that is facing climate risks such as drought and tsunami and is struggling to tackle climate-related issues such as water and air pollution, Mataram needs to act on immediately to find inclusive climate change adaptation strategies to reduce the impact of climate change.

CRIC Project, running from 2020 to 2024, will help Mataram realise its city development vision. The publication of this Urban Analysis Report is part of the ongoing collaboration, with a hope that report results will help Mataram City Government to identify prioritized sectors, policies, strategies and possible cooperation between stakeholders to build a climate-resilient city.

We are grateful that this final report has incorporated feedback and recommendations from stakeholders in Mataram, and we look forward to using this report as a reference when we start our development planning processes.



Thank you.

H. ANWAR ABDUH
Mataram City Mayor



Climate Change is an issue of humanity, it is not merely a threat to the environment only. It is one of most visible humanitarian crises of the century. On very many occasions, we have seen how climate-induced disasters disrupted local economy, food system, basic services and left vulnerable groups more powerless. As an association connecting more than 10,000 cities and local governments in the Asia-Pacific region, UCLG ASPAC is responsible of supporting cities to be climate-resilient, something that we take seriously.

The cost of inaction now is huge. It is therefore urgent for cities to act and find solutions that should be based on data and scientific rigour enabling evidence-based decisions that subsequently reduce the impact of climate change. I emphasise, continual and periodic assessment of risks and change in attributes of cities are critical in enhancing resilience. In light of this, I commend the Climate Resilient and Inclusive Cities (CRIC) team and our urban experts for their hard work to publish this Urban Analysis Report. Great thanks to all the pilot cities of CRIC for their support in producing this Report. It presents a comprehensive outlook on climate risks, programmes and policies at a city level and provides recommendations and solutions to tackle climate change.

This report also underlines the importance of coordination that transcends administrative boundary as climate has no border! It is something that UCLG ASPAC can contribute through the CRIC Programme, by connecting the dots between cities in Asia and the Pacific and beyond within the framework of sub-national and national governments for vertical integration. We intend to bring cities on the centre stage of “Blue Ocean” and “Blue Sky” agenda through action-based proposals and approaches on circular economy, air pollutions and cross-cutting issues. And we are committed to ensuring that climate change best practices can be up-scaled and replicated for greater multiplier impact.

I look forward to seeing how the plans are put into actions to create climate resilient and inclusive cities. Our future will depend on how cities act today. Every concrete step on climate action we make now will bring closer our dream for inclusive, prosperous and sustainable cities and communities.

Dr. Bernadia Irawati Tjandradewi

Secretary General of UCLG ASPAC



As President of Pilot4Dev, I have had the honor to be directly involved in the Climate Resilient and Inclusive Cities Project from its very inception. It was with great pleasure that I attended the CRIC Kick-off event back in January 2020 which allowed us to meet up with our Indonesian partners in order to prepare and launch the project. A great added value from this event was the possibility to meet up with the mayors of the cities piloting the implementation of the project. Today, there is a myriad of cities in need of support in terms of urban environment and climate change resilience.

Pooling the expertise and knowledge of EU partners including ACR+, Pilot4DEV, University Gustave Eiffel, ECOLISE and Asian partners UCL ASPAG and AILSG, this very ambitious five years project aims to establish a long lasting and unique cooperation. It is carried out through a triangular cooperation between cities and research centres in Europe, South Asia (India, Nepal, Bangladesh), and Southeast Asia (Indonesia, Malaysia, Philippines, Thailand). It aims to contribute to sustainable integrated urban development, good governance, and climate adaptation/mitigation through long lasting partnerships, and tools such as sustainable local action plans, early warning tools, air quality and waste management in consultation with experts' panels. The final beneficiaries include the local community of the cities/provinces, including women, marginalised sector, civil society and private sectors.

Now entering the 10th month of its implementation, this project has already proven to be a fruitful endeavor now implemented in 10 different cities in Indonesia. Among the chief results obtained so far, 10 urban analysis reports have been written and edited, and assess the current capacities of the different target cities. The project in itself has required the direct involvement of local authorities' officials, generating a real eagerness to make the cities more resilient and inclusive at the local level. The next steps of this project will involve the release of the Urban Analysis Reports along with policy briefs and recommendations adapted to the different pilot cities which have been involved in the project so far. This release will be completed by the creation of tools put together by the International Partners of the CRIC project, in order to equip local authorities and possibly tackle the urban and environmental challenges they face.

Due to high urban growth rates in countries such as Indonesia, Vietnam and the Philippines it is predicted that a significant share of the population of those countries will be living in cities in the next ten years. Cities in the South Asian and South East Asian regions are already impacted by climate change, and they could substantially benefit from long lasting solutions in terms of climate resilience and inclusiveness. The CRIC Project aims to inform and facilitate the equipment of local governments, cities, urban stakeholders working on climate resilience, mitigation and adaptation of those cities by pooling the best resources available and transferring and adapting as much knowledge as possible. Since urban areas host most of the vulnerable populations, as well as vital and social infrastructure, and local governments get increased pressure to develop services, infrastructure and employment, it is therefore of utmost urgency to make sure that we are all up for the challenge presented by climate change.

Isabelle Milbert, President of Pilot4Dev



The CRIC project represents for the Association of Cities and Regions for sustainable resource management (ACR+) - a network of local and regional authorities mainly based in the EU and the Mediterranean Area - a unique opportunity to cooperate and strengthen the role of cities to deliver on resiliency and inclusiveness.

ACR+'s core mission is to develop sustainable resource management initiatives involving local and regional authorities; in particular regarding waste management, one of the priorities raised by the urban analysis report. As such and for more than 25 years, we have been designing and implementing initiatives on circular economy, waste prevention, and waste management, building through this an extensive knowledge basis. Several ACR+ members have been already cooperating in the South-East region, whose experiences could be capitalized on and further developed through CRIC.

Conversely, this project provides a great learning opportunity for ACR+ members, to understand how local initiatives make a difference at global level. The present report contributes to effectively comprehend the local context, shedding the light on the key challenges and priorities. It shows that the exchange of methodologies to support decision-making processes rather than transfer solutions is crucial to successfully deliver sustainable projects.

However, more than a mere exchange of experiences, CRIC is a timely reminder that cooperation is key, at all levels and between countries. The EU cannot deliver alone the ambition of the European Green Deal for a climate-neutral, resource-efficient and circular economy. Activities like the ones developed within the CRIC project (trainings, stakeholder engagement, tools development, local action plans) can provide solid evidence to support bilateral and regional policy dialogue actions aimed at implementing the Green Deal and 2030 Agenda's objectives beyond the EU. Unfortunately, we cannot and should not forget the wider context in which the project is unfolding: the COVID-19 outbreak has been posing tremendous challenges at local level. With the hindsight we have so far, we see that local agenda based on resilient models contribute to better adapt and mitigate the negative impacts of the pandemic. Having this in mind, ACR+ has been supporting its members in overcoming the situation and is determined to also follow this path in CRIC.

Françoise Bonnet

ACR+ Secretary General

A handwritten signature in blue ink, appearing to read 'F. Bonnet', written in a cursive style.

ABOUT THE AUTHORS



Wahyu Mulyana is an independent consultant with more than 24 years of experience in the areas of urban and regional development, housing and human settlement management, spatial planning, environmental management and climate change adaptation. He obtained his Doctoral Degree in Environmental Science from the University of Indonesia in 2019; his Master of Arts (M.A) in Urban Management from the Erasmus University of Rotterdam and Institute for Housing and Urban Development Studies (IHS) in 2001 and his Bachelor Degree in Urban and Regional Planning from Bandung Institute of Technology (ITB) in 1995.

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Fransiska Falentina Sugi



Asih Budiati



Maria Serenade



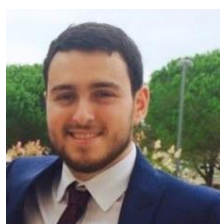
Putra Dwitama

We are especially grateful to Fransiska Falentina Sugi, Field Officer in charge of the Nusa Tenggara region who liaised regularly with local officials to facilitate access to the data necessary for this report.

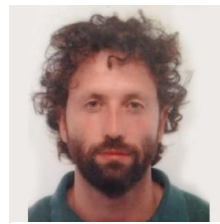
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Dr. Pascaline Gaborit



Emmanuel Rivéra



Paolo Marengo



Danko Aleksic

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GLOSSARY

AKAP	<i>Antar Kota Antar Provinsi</i> Inter-Provincial
AKPD	<i>Antar Kota Dalam Provinsi</i> Inter-Cities Within Province
API PRB	<i>Adaptasi Perubahan Iklim dan Pengurangan Risiko Bencana</i> /Climate Change Adaptation and Disaster Risk Reduction
BAPPEDA	<i>Badan Perencanaan Pembangunan Daerah</i> /Local Development Planning Board
BAU	Business-as-usual
BMKG	<i>Badan Meteorologi, Klimatologi, dan Geofisika</i> /Meteorology, Climatology, and Geophysics Board
BNPB	<i>Badan Nasional Penanggulangan Bencana</i> /National Board for Disaster Management
BOD	Biochemical Oxygen Demand
BPBD	<i>Badan Penanggulangan Bencana Daerah</i> /Local Disaster Management Board
CBS	Central Bureau of Statistics
COD	Chemical Oxygen Demand
CRIC	Climate Resilience Inclusive Cities
DINKES	<i>Dinas Kesehatan</i> / Health Agency
DISHUB	<i>Dinas Perhubungan</i> / Transportation Agency
DLHK	<i>Dinas Lingkungan Hidup dan Kebersihan</i> /Environment and Cleaning Agency
DO	Dissolved Oxygen
DPKP	<i>Dinas Perumahan dan Kawasan Permukiman</i> /Settlement and Housing Agency
DPUPR	<i>Dinas Pekerjaan Umum dan Penataan Ruang</i> /Spatial Planning and Public Works Agency
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GRDP	Gross Regional Domestic Product
GIZ PAKLIM	Deutsche Gesellschaft für Internationale Zusammenarbeit - Policy advice for environment and climate change
HDI	Human Development Index
IDB	Islamic Development Bank
IDR	Indonesian Rupiah
INDC	Intended Nationally Determined Contributions
KLHK	<i>Kementerian Lingkungan Hidup dan Kehutanan</i> /Ministry of Environment and Forestry
KOTAKU	<i>Kota Tanpa Kumuh</i> /Cities Without Slums
KSP	<i>Kawasan Strategis Provinsi</i> /Provincial Strategic Area
LAP	Local Action Plan
LED	Light Emitting Diode
LULUCF	Land Use, Land Use Change, and Forestry
NDC	Nationally Determined Contribution
NGO	Non-Government Organisations
NTB	<i>Nusa Tenggara Barat</i> / West Nusa Tenggara
PAMSIMAS	<i>Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat</i> /Community Based Water Supply
PDAM	<i>Perusahaan Daerah Air Minum</i> /Local Water Company
PKN	<i>Pusat Kegiatan Nasional</i> /National Activity Centre

PLTD	<i>Pembangkit Listrik Tenaga Diesel/ Diesel Power Plant</i>
PLTGU	<i>Pembangkit Listrik Tenaga Gas dan Uap/Gas and Steam Power Plant</i>
PROPER	Company's Performance Rating
RAN GRK	<i>Rencana Aksi Nasional Gas Rumah Kaca/National Action Plan for Green House Gas Emission Reduction</i>
RAD GRK	<i>Rencana Aksi Daerah Gas Rumah Kaca/Local Action Plan for Green House Gas Emission Reduction</i>
RAN API	<i>Rencana Aksi Nasional Adaptasi Perubahan Iklim/National Action Plan for Climate Change Adaptation</i>
REDD	Reducing Emissions from Deforestation and Forest Degradation
RPJMD	<i>Rencana Pembangunan Jangka Menengah Daerah/Local Medium-term Development Plan</i>
RPJMN	<i>Rencana Pembangunan Jangka Menengah Nasional/National Medium-term Development Plan</i>
RPPKPKP	<i>Rencana pencegahan dan Peningkatan Kualitas Permukiman Kumuh Perkotaan/ Slum Prevention and Quality Improvement Plan</i>
RRR (3R)	Reuse, Reduce, dan Recycle
RTLH	<i>Rumah Tidak Layak Huni/Non-livable Houses</i>
RTRW	<i>Rencana Tata Ruang Wilayah/Spatial Plan</i>
RTRWN	<i>Rencana Tata Ruang Wilayah Nasional/National Spatial Plan</i>
SANIMAS	<i>Sanitasi Berbasis Masyarakat/Community Based Sanitation</i>
SEA	Strategic Environmental Assessment
SDGs	Sustainable Development Goals
SIDIK	<i>Sistem Informasi Data Indeks Kerentanan/Vulnerability Index Data Information System</i>
SIGN SMART	National GHG Inventory System
SPAM	<i>Sistem Penyediaan Air Minum/Regional Water Supply Provision System</i>
SSDP	Sewerage System Development Project
SSK	<i>Strategi Sanitasi Kota/City Sanitation Strategy</i>
SUSENAS	<i>Survei Sosial Ekonomi Nasional/National Socio-Economic Survey</i>
TPA	<i>Tempat Pembuangan Akhir/Final Disposal Site</i>
TPST	<i>Tempat Pembuangan Sampah Terpadu/Integrated Waste Processing Site</i>
TSS	Total Suspended Solid
UN	United Nations
WRS	Warning Receiver System
WWF	World Wide Fund for Nature

INTRODUCTION

Indonesia has experienced a high rate of urbanization, and that trend will continue in the next decades. It is expected that 72.8% of the population will live in urban areas in 2045 (Bappenas et al., 2018). Rapid urbanization is characterized by the urban agglomeration in large cities and metropolitan areas as well as the fast growing of small and medium cities. As an archipelagic country with extensive low-lying areas, Indonesia is highly vulnerable to adverse impacts of climate change and extreme climate events such as floods, drought, and sea-level rise. Climate change-induced natural disasters will also affect a great number of people and their assets in urban areas. Many cities are in coastal areas, riverbanks and low-lying areas which have a high risk of coastal inundation, sea-level rise and flooding.

Mataram is a coastal city located in the small exotic island of Lombok which has a very rich natural attraction. Lombok Island is geologically situated on the subduction zone between two major plates of India-Australia and Eurasia, which causes this area to be vulnerable to earthquakes (Ramdani et al., 2019). As a small island, Lombok is also vulnerable to harmful impacts of climate change and hydro-meteorological disasters, including sea-level rise, extreme waves, abrasion and drought (Suroso et al., 2009). Mataram area is surrounded on all the landward sides by West Lombok Regency. Three towns constitute Mataram area: Ampenan, Cakranegara and Mataram. They are distinct towns but run together.

This CRIC Urban Analysis Report for aims at analysing the situation, policies and baseline data about Mataram. It employs a qualitative research method combining desk-study approach and interviews with key informants. The systematic desk study is a research technique which basically requires data collection from existing secondary data sources, including journal or published articles, government statistical reports, city and sectorial planning documents. Interviews were conducted with key informants representing local stakeholders such as local government officers, non-governmental organisations, private sector and academia. A descriptive analysis was used to assess key problems, challenges and opportunities in related sectors. The report comprises of an introduction, an overview of the city, a section about challenges and opportunities, and last, recommendations.

Figure 1. The Gate of Tembolak, Mataram



Source: Potret24.com

CHAPTER 1

Overview of Mataram

1.1 General Description

Mataram is the capital city of West Nusa Tenggara (NTB) Province. The city is surrounded by West Lombok Regency and Lombok Strait. It is also the largest city in Lombok Island with a land area of 61.3 km² and a coastline of 9 km. Other regencies in Lombok Island are: West Lombok, East Lombok, North Lombok and Central Lombok. The city is crossed by four large rivers that function as natural drainage, which are Jangkok River, Ancar River, Brenyok River and Midang River. Upstream areas of these rivers are around the slopes of Mount Rinjani and flow into downstream in Lombok Strait.

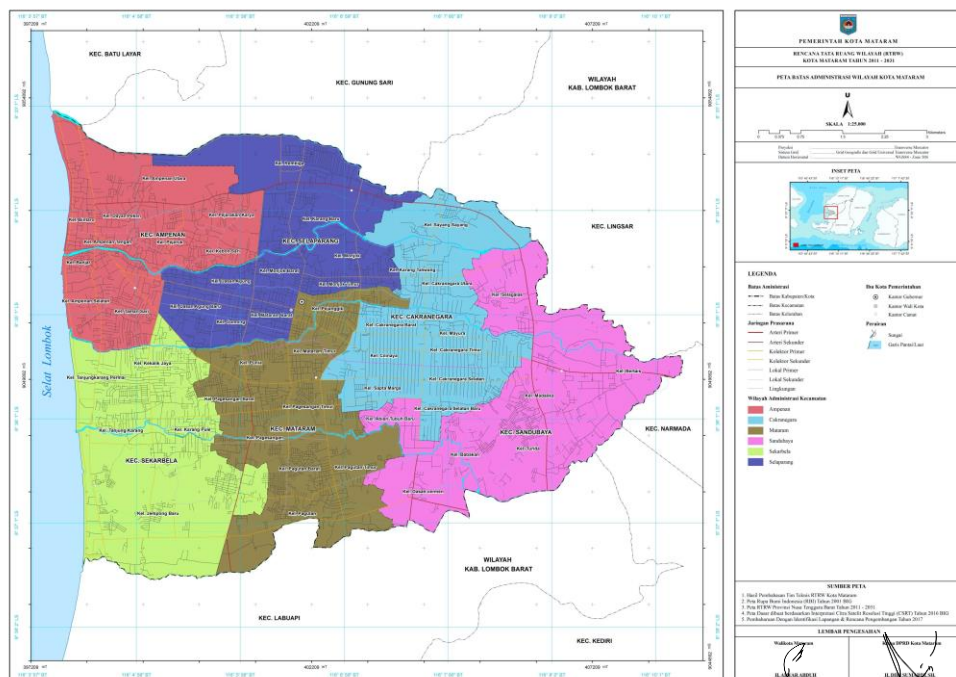
The city is administratively divided into six districts, namely Ampenan, Cakranegara, Mataram, Selaparang, Sekarbela and Sandubaya. The Mataram area contains 50 villages and 325 neighborhood units.

In the national development context, Mataram is stipulated as a National Activity Centre (*Pusat Kegiatan Nasional/PKN*), which specifically has the function to support the economic development in Lombok Island mainly on tourism, poultry and plantation industries (RPJMN 2020-2024). Furthermore, the Provincial Spatial Plan (RTRWP 2009-2029) stipulated that Mataram Metro as Province's Strategic Area (*Kawasan Strategis Provinsi/KSP*) has potential economic sectors which are trade, service, industry and tourism. The Metropolitan area comprises Mataram and six subdistricts in West Lombok Regency namely Batulayar, Gunungsari, Lingsar, Narmada, Labuapi and Kediri.

The long city history began from the Kingdom era until the colonization era. After Indonesian independence, Lombok was part of the Bali-Lombok Residency. During the founding of the State of East Indonesia (1946-1950), the autonomous region was divided into three administrative regions: Bali, West Lombok and East Nusa Tenggara. In 1958, West Nusa Tenggara officially became a Province. Mataram was then designated as the Province's capital city as well as the capital city of West Lombok Regency. In addition to that, Mataram has also become the centre of education, commerce, industry and services.

Since the enactment of Law No. 18 of 1965, West Lombok Regency has developed into a number of subdistricts including Mataram District, which is the division of Ampenan and Cakranegara Districts. These three districts were subsequently formed as Mataram Administrative City through Government Regulation No. 21 of 1978. Furthermore, the status of Mataram Administrative City was changed into the Municipality of Mataram by Law No. 4 of 1993 and was inaugurated on August 31, 1993, which territory includes Mataram, Ampenan and Cakranegara Districts. Since 2007, Mataram is administratively divided into six subdistricts.

Figure 2. Administrative Map of Mataram



Source: Local Regulation No. 5 Year 2019 on the Revised Spatial Plan of Mataram 2011-2031

1.2 Topography and Climatology

The topography of Mataram is divided into a flat-sloping area in the west and undulating area in the east. In general, the city is elevated at the range height of 0 – 75m above sea level. The elevation of areas located on the coast, in Ampenan and Sekarbela Districts, is less than 15m above sea level, while in the Eastern part, Cakranegara and Sandubaya Districts, the height ranges between 40 and 80m above sea level. Ampenan, Sekarbela and Mataram Districts are characterized by a 0-8% range slope, while Cakranegara, Selaparang and Sandubaya Districts have a 10-15% range slope.

Mataram has a tropical climate with a rainy season from October to April and a dry season the rest of the year. The average temperature reaches 26°C with an average humidity reaching 82%. The local climate is also affected by wind changes. From April to October, there are usually dry winds coming from the Southeast that are characteristic of the dry season whereas from November to March, the Northwest wind containing water vapor causes the rainy season. The wind speed is quite high in rainy season and lower in dry season.

1.3 Demographic Characteristics

Mataram is an autonomous region located on the small island of Lombok which has a high population density. The total population in 2019 amounted to 486,715 people, with an increase of 83,872 people compared to 2010. However, the city's population growth declined from 2.54% between 2000 and 2010 to 1.91% in 2010 – 2019. Overall, Mataram contributes to 13.7% of the total population in Lombok Island.

Likewise, the East Lombok Regency has experienced a decrease in the population growth from 1.34% in 2000 – 2010 to 0.83% in 2010-2019. In the meantime, the population in West Lombok has steadily decreased in the last three decades as a result of the splitting of subdistricts into Mataram in 1993 and North Lombok in 2008. The administrative changes reduced the total area of West Lombok Regency, while the population growth in 1990 – 2000 is still calculated by using the similar administrative boundary in 1990. In the period 2010 – 2019, the population growth of West Lombok Regency slightly increased at the rate of 1.48% per year. The total population in Lombok Island reached 3.5 million in 2019 with a population growth of 1.14%.

Table 1. Population in Lombok Island, 2019

City/Regency	2019 Population	Annual Population Growth (%)			Area (km ²)	2019 density (pop/km ²)	Number of subdistrict
		1990-2000	2000-2010	2010-2019			
Mataram*)	486,715	-	2.54%	1.91%	61.30	7,940	6
West Lombok	694,985	-2.60%	-0.95%	1.48%	1,053.9	659	10
East Lombok	1,200,612	1.12%	1.34%	0.83%	1,605.6	748	20
Central Lombok	947,488	0.91%	1.47%	0.97%	1,208.4	784	12
North Lombok*)	200,072	-	-	0.97%	809.5	272	5
Lombok Island	3,529,872	1.11%	1.09%	1.14%	10,807.4	749	53

Source: Analysis from various sources, 2020

*) Mataram was officially established in 1993 as a division from West Lombok Regency

***) North Lombok Regency was officially established in 2008 as a division from West Lombok regency

In 2010, the population of Mataram was still concentrated in the subdistricts of Ampenan, Mataram and Selaparang. Since 2015, Sekarbela District has the highest population growth compared to other subdistricts. Meanwhile, the highest population density is still in Ampenan Subdistrict, which reached 9,975 people/km² in 2019. Sekarbela and Sandubaya subdistricts gradually experienced an increase in population density in 2015 and 2019.

Table 2. Population Distribution and Density by Subdistrict, 2010 – 2019

Subdistrict	Area (km ²)	Number of Population			Pop. Growth		Pop. Density		
		2010	2015	2019	2010-2015	2015-2019	2010	2015	2019
Ampenan	9.46	79,093	87,746	94,363	2.1%	1.8%	8,361	9,275	9,975
Sekarbela	10.32	53,331	64,946	75,254	4.0%	3.8%	5,168	6,293	7,292
Mataram	10.76	73,410	83,479	91,568	2.6%	2.3%	6,822	7,758	8,510
Selaparang	10.77	72,965	74,795	75,509	0.5%	0.2%	6,775	6,945	7,011
Cakranegara	9.67	64,358	66,983	68,455	0.8%	0.5%	6,655	6,927	7,079
Sandubaya	10.32	61,345	72,277	81,566	3.3%	3.1%	5,944	7,004	7,904
Total	61.3	404,502	450,226	486,715	2.2%	2.0%	6,599	7,345	7,940

Source: CBS of Mataram 2010-2019

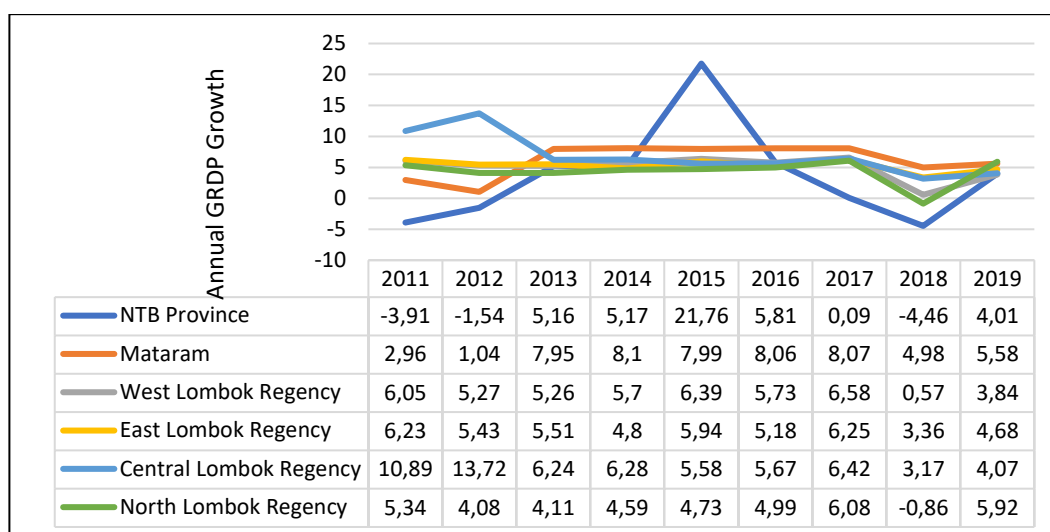
1.4 Economic Structure

1.4.1 City's Economic Growth

The economic growth of Mataram has experienced fluctuations with a rapid increase and decrease in the last ten years. The city economy grew by a rate of 2.9% in 2011, then slightly reached a growth rate of 8.07% in 2017, followed by a decline rate of 5.58% in 2019. The decreasing economic growth in 2019 is affected by the impacts of the earthquake that devastated some of the city's areas in 2018.

Compared to West Nusa Tenggara Province, the economic growth rate of Mataram is substantially higher than the one in the Province, except in 2015 when the West Nusa Tenggara Province received a large contribution from mining and quarrying due to government policies to prohibit export of concentrate. In 2019, Mataram contributed to almost 14.7% of the Provincial GRDP, similar to the contribution of other regencies including East Lombok (15.3%), Central Lombok (13.2%) and West Lombok (11.6%). In total, the contribution percentage of the city and regencies in Lombok Island to Provincial GRDP is about 58.5%.

Figure 3. GRDP Growth 2011-2019



Source: CBS of West Nusa Tenggara Province 2011-2019

1.4.2 GRDP Per Capita

GRDP per capita indicates the magnitude of economic activities generated by each people in the city. Between 2011 and 2019 the GRDP per capita of Mataram continued to increase from USD 1,471 (IDR 20.6 million) in 2011 to USD 2,021 (IDR 28.3 million) in 2019. GRDP per capita of Mataram is the highest compared to West Nusa Tenggara Province and other regencies.

1.4.3 City's Economic Sectors

The economic structure of Mataram is dominated by wholesale and retail trade, car repairs and the motorbikes sectors which contribute to approximately 20% of the city's economy in 2019. Its position as an economic centre leads to very rapid trade development. The trade sector is a significant economic driving force in Mataram, with its growth rate reached 3.36% in 2010-2019. Another dominant sector is construction.

Apart from the trade and services sector, the economic activities of Mataram are still marked by activities in the agricultural, forestry and fisheries sectors, contributing altogether to around 3.54% of the GRDP in 2019, with an annual growth of 1.16%. The agricultural land is spread over 6 districts, and the land availability is different due to land-use changes in each subdistrict.

Sandubaya Subdistrict has an agricultural land of 603.96 hectares, which is the largest compared to other subdistricts. The agricultural commodities include horticulture, cattle breeding and fisheries which are used for local consumption. In addition, the municipal government has also developed the Sustainable Home Food program, which is implemented through the optimal use of yards for the development of diverse food availability at the household level. This activity is carried out in several villages and contributes to the empowerment of women.

Table 3. GRDP Structure of Mataram, 2019

No.	Sector	Share 2010	Share 2015	Share 2019	Growth 2010-2019
1	Agriculture, Forestry and Fishing	4.72%	4.12%	3.54%	1.16%
2	Mining and quarrying	0.01%	0.01%	0.01%	0.07%
3	Manufacturing	10.45%	10.34%	10.00%	2.49%
4	Electricity and gas	0.08%	0.12%	0.11%	2.78%
5	Water, sewage and waste management	0.18%	0.19%	0.16%	0.99%
6	Construction	9.40%	11.12%	11.36%	3.12%
7	Wholesale and retail trade, repair of motor vehicles and motorcycles	15.54%	19.39%	20.24%	3.36%
8	Transportation and Storage	18.25%	6.19%	6.28%	3.05%
9	Accommodation and food service activities	1.19%	1.46%	1.47%	2.96%
10	Information and communication	6.14%	7.32%	7.38%	2.96%
11	Financial and insurance activities	6.28%	9.08%	9.78%	3.72%
12	Real Estate activities	3.94%	4.79%	4.92%	3.18%
13	Business activities	0.35%	0.43%	0.45%	3.29%
14	Public administration and defense, compulsory social securities	8.05%	7.31%	6.19%	1.00%
15	Education	6.63%	7.96%	8.02%	2.95%
16	Human health and social work activities	4.39%	4.99%	4.98%	2.87%
17	Other services activities	4.40%	5.18%	5.10%	2.70%

Source: CBS of Mataram 2010-2019

1.4.4 Employment

As shown in Table 3, the market, the most important sectors (here, trade and services) contribute to more than 79% of the workforce in 2019. There were 172,972 workers in Mataram working in these sectors. The second position was occupied by the manufacturing industry sector, which absorbed 41,115 workers. Agriculture, forestry and fishing absorb the smallest workforce, accounting for 5,027 workers. This condition is in line with the fact that the agriculture, forestry and fishing sectors have a small contribution to the city's economy compared to other business sectors.

Apart from functioning as the centre of government and economy in NTB Province, the city has also potential tourist attractions for developing city tourism such as shopping places, diverse local gastronomy, city parks, culture, arts, and beautiful beaches. However, the tourism potential has not been able to attract the expected number of tourists to Mataram. The number of visiting tourists in 2016 was 623,835 people, still below the number of tourists visiting North Lombok and West Lombok.

1.5 Social Structure

1.5.1 Human Development Index

The progress of social development in Mataram reflected by the Human Development Index (HDI) which is composed of three dimensions: (1) a long and healthy life, (2) education and (3) a decent standard of living. The HDI of Mataram in 2010 was 72.47, where the HDI achievement was classified as high ($70 \leq \text{HDI} < 80$) and increased to 79.1 in 2019. The HDI of Mataram was above the HDI of NTB Province, namely 68.14 and the HDI of Indonesia (71.92), as can be seen in this following table.

Between 2010 and 2019, the life expectancy at birth increased, which means that the quality of public health improved, accordingly to the increasing numbers of health facilities and health workers. Nevertheless, the efforts to come up with a comprehensive and cross-sectoral public health status must be continuously carried out in order to improve the public health status in the future.

Table 4. Human Development Index 2010 – 2019

Indicator	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Life expectancy at birth	69.16	69.45	69.73	70.03	70.18	70,43	70.7	70.98	71.24	71.59
Expected years of schooling	14.31	14.61	14.77	14.82	15.27	15,28	15.5	15.51	15.52	15.58
Mean years of schooling	8.15	8.47	8.61	9.04	9.04	9,05	9.25	9.32	9.43	9.45
Income per capita	11,80	12,05	12,38	12,74	13,02	13,39	13,73	14,31	14,79	15,42
HDI Mataram	72.47	73.5	74.22	75.22	75.93	76.37	77.2	77.84	78.43	79.1
HDI NTB Province	61.16	62.14	62.98	63.76	64.31	65.19	65.81	66.58	67.30	68.14
HDI Indonesia	66.53	67.09	67.70	68.31	68.90	69.55	70.18	70.81	71.39	71.92

Source: CBS of Mataram 2010-2019

Concerning education, the expected years of schooling keep increasing from year to year in line with more improved school enrolment for children. At the same time, the mean years of schooling is also increasing, as the community becomes more aware of the importance of education. In 2010, the mean years of schooling were 8.15 years and it significantly increased to 9.45 in 2019. This means that the population of Mataram averagely went to school for 9.45 years or at the same level as grade 10 (first year in senior high school). Thus, the 9 years compulsory education in Mataram can be surpassed. A decent standard of living is indicated by the component of per capita expenditure. The higher the income level, the higher the ability of the population to meet their needs.

1.5.2 Ethnic Groups

In term of social-cultural aspects, Mataram's inhabitants are from various ethnic backgrounds: among others are Sasak, Mbojo, Samawa, Balinese, Javanese, Sundanese, Madurese, Bugis, Minang, Sumba and Arab ethnicities. Since the colonial period, segregation has been based on the hometown's ethnicity (Natsir, 2014). Human settlements are concentrated based on ethnicity and the division of labour, i.e. Kampung Melayu, Kampung Bugis, Kampung Banjar, Arab Village and Chinatown located around the harbor area of Ampenan. Meanwhile, the settlements of Sasak and Balinese are relatively dispersed, displaying patterns of spider webs in which the village of Bali as patron (landowners) are generally surrounded by two to four Sasak villages, as a client or provider of labor (workers/laborers) in the agriculture.

The attractiveness of Mataram as the center of economic activity has had an impact on rural exodus i.e. migration from the countryside to the city. The dynamics of population growth also lead to various social problems, including people with social welfare problems, neglected children, urban poverty and social conflicts. As a consequence of such diverse and heterogeneous population, Mataram is more likely to experience horizontal social conflict (Natsir, 2014).

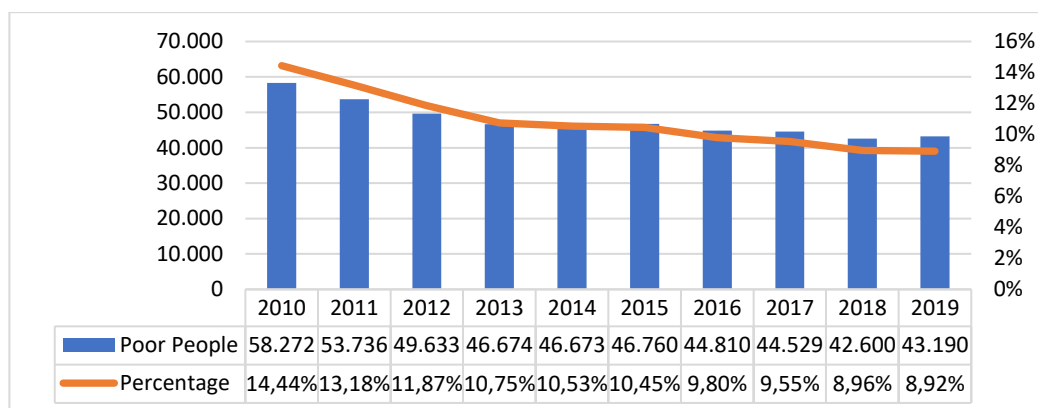
1.5.3 Poverty and Inequality

The concept of poverty refers to the ability to meet basic needs measuring two indicators of poverty line. First, the food poverty line is the value of the minimum food expenditure equivalent to 2,100 kilo-calories per capita per day. Second, the non-food poverty line is the minimum needs for housing, clothing, education and health.

In the period 2010-2019, both the percentage and number of poor people in Mataram have slightly decreased with a rate of around 0.03 - 1.3% per year. In 2019, the number of poor people reached 43,190 people or 8.92% of total population. The incomplete poverty alleviation is caused by the existence of the poorest of the poor within the community groups. Extreme poverty is not easy to alleviate and it takes time to develop welfare policies.

The income inequality in Mataram has reached 0.537 in 2017, representing high income inequality among the population. It is affected by the important population growth, which causes a decline in people's income and expenditure. Compared to other regencies, the inequality in Mataram is lower than in the West Lombok Regency where it reached 0.976; the Central Lombok Regency with 0.917; the East Lombok Regency with 0.816 and the North Lombok Regency with 0.813. The income inequalities can be reduced through jobs creation and skills improvement. The productive age group (15 - 64 years) is around 66% of population, but they have limited access to labour market and productive sector, resulting in high unemployment among this population.

Figure 4. Poverty in Mataram, 2010-2019



Source: CBS of Mataram 2010-2019

1.5.4 Slum Settlements

Mataram still faces the problem of slum settlements which is characterized by the lack of basic urban infrastructure and services. After going through a series of studies and discussion of the delineation of slum settlements, the municipal Government has determined which settlements require quality improvement interventions, accounting for 303.57ha until 2019, spread over 25 urban villages and around 499.82ha as locations for preventing the slum settlements growth (DPRKP, 2018).

The handling of slum settlements is classified into two different approaches: first, the Settlement Area (1) in which there is a complex problem and a need of comprehensive solutions; second, the Neighborhood scale (2) which refers to the whole neighborhood and indicates whether it could be improved or not. Referring to the scale of improvement, slum settlements in Mataram can be categorised into four clusters, namely: (1) Coastal areas with the area of 44.97 Ha (14.81%), (2) Jangkok Riverbank with an area of 73.21 Ha (24.12%); (3) Ancar Riverbank with an area of 22.37 Ha (7.37%) and (4) Trade and business center with 14.09ha area (4.64%). The remaining are non-clustering settlements spread out in the city within the area of 105.45 Ha (42%) which can be addressed through neighborhood-scale improvement.

In general, there are two slum alleviation programs. The first program is a national flagship program known as City Without Slums (KOTAKU) which is implemented in 269 Indonesian cities/regencies under the financing from the Islamic Development Bank (IDB) and the World Bank. The second program is implemented thanks to the local government budget. Mataram has been combining both programs in address its slum settlements since 2016, including the improvement of settlements that were devastated by the 2018 earthquake. According to the latest evaluation in 2020, the remaining slum settlements surface which needs to be improved is around 97.2 ha covering 7 (seven) slums villages.

Table 5. Slum Settlements in Mataram

No.	Subdistrict	No. of Village	No. of Slum Village	Slum Area 2016 (Ha)	Characteristic of Location	Disaster Risk
1	Ampenan	19	7	90.97	Coastal area, riverbanks, and urban fringe	Coastal abrasion; rob flooding
2	Sekarbela	5	3	50.52	Coastal area, riverbanks, and urban fringe	Coastal abrasion; flooding
3	Mataram	9	2	9.46	Urban fringe	Flash flood
4	Selaparang	9	6	92.13	Riverbanks	Flash flood
5	Cakranegara	10	4	31.78	Commercial Area	Flash flood
6	Sandubaya	7	3	48.72	Commercial Area	Flash flood
Total		59	25	323.58		

Source: RP2KP-KP Mataram 2018

1.6 Environmental Data

1.6.1 Air Quality

The measurement of ambient air quality in Mataram is carried out at four sampling locations representing industrial, residential, transportation and office areas using the manual passive sampling method with predetermined requirements and criteria. This passive sampling is conducted two times a year following the season, i.e. dry and wet season.

Based on the results of air monitoring in 2019, the air quality index of Mataram is 88.80 showing that the air quality is in very good condition based on the national index. Although the monitoring points do not represent all subdistricts, the monitoring locations that are at the center of community activities are considered sufficient to represent the city air quality.

Table 6. The Measurement of Air Quality Indeks in Mataram, 2019

No.	Category	NO ₂ (µg/Nm ³)		SO ₂ (µg/Nm ³)		Average	
		I	II	I	II	NO ₂ (µg/Nm ³)	SO ₂ (µg/Nm ³)
1	Transportation	6.60	6.50	4.66	3.55	6.55	4.01
2	Industry	9.30	10.20	13.90	10.09	9.75	11.99
3	Settlements	8.00	8.70	4.83	6.02	8.35	5.43
4	Office area	9.70	10.10	10.10	9.04	9.90	9.57
		Average of monitoring				8.64	7.75
		Quality Standard				40	20
		Index				0.215	0.3874
		Index of Air (Annual Model EU)				0.3017	
		Index of Air Quality				88.80	

Source: Index of Environmental Quality Mataram, 2019

1.6.2 River Water Quality

Monitoring of river water quality in Mataram was carried out in the Jangkok river in 2019. Sampling for one year was taken four times in three locations (Upstream, Middle, and Downstream). The measuring of water quality assesses these parameters: Total Suspended Solid (TSS), Dissolved Oxygen (DO), COD, Biochemical Oxygen Demand (BOD), Phosphate, Total Coliform and E. Coli/Fecal Coli as outlined in the table below.

Table 7. The Measurement of Water Quality in Jangkok River, 2019

Period	Sampling Location	Temp	TSS	DO	BOD	COD	Fosfat (PO ₄)	E. Coli	Total Coliform
		°C	mg/L	mg/L	mg/L	mg/L	mg/L	MPN/100mL	MPN/100mL
I Mar 19	Upstream	28.5	33.62	7.10	2.0	4.0	0.08	1.000	4.500
	Middle	27.7	58.78	7.18	4.0	7.87	0.09	6.000	14.000
	Downstream	27.4	30.27	5.80	2.0	4.0	1.40	8.000	16.000
II Jun 19	Upstream	25.0	1.11	7.04	2.0	4.0	0.12	240	4.500
	Middle	27.7	1.98	6.00	2.0	4.0	0.19	550	4.500
	Downstream	29.95	3.28	2.48	2.7	24.96	0.25	3.400	3.400
III Sep 19	Upstream	26.0	1.69	1.69	2.0	4.67	0.12	240	2.000
	Middle	27.1	2.85	1.30	2.0	5.7	0.19	340	24.000
	Downstream	28.3	29.67	1.00	4.3	17.5	0.31	12.000	16.000
IV Des 19	Upstream	28.0	26.49	3.85	2.0	20.7	0.02	350	24.000
	Middle	29.0	16.60	1.93	2.0	10.54	0.10	1.100	2.400
	Downstream	30.0	37.31	5.49	4.6	22.98	0.15	1.600	2.400

Source: Index of Environmental Quality Mataram, 2019

Based on the results of the above measurements, the status of water pollution in Jangkok river observed in 2019 can be seen in the Table.

Table 8. The Status of Water Pollution in Jangkok River, 2019

Sampling Location	Period I		Period II		Period III		Period IV	
	PI	Status	PI	Status	PI	Status	PI	Status
Upstream	0.81	Fulfill QS	0.69	Fulfill QS	0.54	Fulfill QS	0.67	Fulfill QS
Middle	3.66	Lightly polluted	0.75	Fulfill QS	3.20	Lightly polluted	0.94	Fulfill QS
Downstream	4.22	Lightly polluted	2.71	Lightly polluted	4.78	Lightly polluted	1.60	Lightly polluted

Source: Index of Environmental Quality Mataram, 2019

1.6.3 Land Cover Quality

Land cover is the condition of the observed biophysical appearance of the earth's surface. Land use is the arrangement, activities and inputs of certain types of land cover to produce something, change or maintain it. The method used follows the PERDIRJEN Number P.1/PPKL/PKLAT/PKL.4/1/2018 as a guideline for Measuring Land Cover Quality Index and Land Cover Management.

Table 9. Land Cover Quality in Mataram, 2019

No.	Component of Land Cover	Area (ha)	Note
1	Urban Forest	11.4	Forest
	Total (1)	11.4	
2	Riverbanks	542.75	Brush which has conservation function
	Coastal banks	125.76	
	Spring area	1.71	
	Total (2)	670.22	
3	Green Open Space in Neighborhood	213.82	Green open space
	Green Open Space in Village	15.65	
	Green Open Space in Subdistrict	8.79	
	City Parks	74.78	
	Green Belt	754.97	
	Green Open Space in Coastal banks	32.4	
	Green Open Space in Riverbanks	15.88	
	Cemetery	109.71	
	Total (3)	1.226	
4	Total (4) = Total ((2) + (3)) x 0.6	1.137,73	
5	TOTAL	1.149,13	
6	Total area of Mataram	6.000,7	
7	Land Cover	0.19	
8	Land Cover Quality Index	39.87	

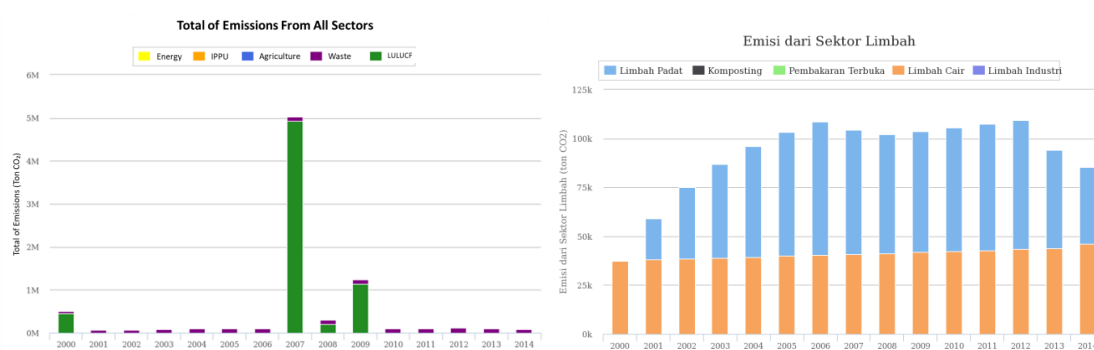
Source: Index of Environmental Quality Mataram, 2019

1.6.4 Greenhouse Gas Emission

GHG emissions in the city of Mataram are largely determined by the size of urban activities. In general, the largest contributor to GHG emissions in Mataram is the waste sector, particularly solid waste and liquid waste. This relates to waste generated by settlements, industry, trade and services.

The National GHG Inventory System (SIGN SMART) shows that the GHG emissions of Mataram in 2014 amounted to 85,187ton CO₂ produced from the waste sector. The highest GHG emissions occurred in 2007 with around 5,030,953ton CO₂. The largest emitter was from land use, land-use change and forestry (LULUCF) sector, generating in total 4,926,503 Ton of CO₂ (97.92%). Therefore, the handling of waste management is very crucial for the City of Mataram, both for environmental health and the reduction of GHG emissions.

Figure 5. GHG Emissions in Mataram



Source: SIGN SMART

1.6.5 Solid Waste

Rapid population growth has posed serious challenges for the management of urban waste. The amount of waste generated reached 1,106 m³/day in 2019, nearly three times higher than the waste generated in 2011, which was 446.79 (LSS, 2019; Widayanti et al., 2017). Waste sources come from the public market and commercial areas (66.2%), road and public facilities (25%), industries and office areas (4%), residential (1.6%) and others. The composition of waste is divided into organic waste (76.85%), inorganic waste (22.95%) and hazardous waste (0.20%).

It is the responsibility of the Environmental Agency to collect and transfer solid waste to the final disposal site at TPA Kongok in West Lombok Regency. This is a 8.6 ha controlled landfill site under the cooperation of Mataram and West Lombok Regency since 2006. The amount of waste transported every day is only 273 tons.

Solid waste management in Mataram is facing the challenges to reduce waste generation at the source and properly process the collected waste. The percentage of waste reduction at sources is relatively small, covering only 3% of the total waste generated. It is carried out through the 3R's: reduce, reuse and recycle. Waste handling by the city government reaches 80% of the total waste generation, which is then collected and disposed of at the final processing site. Waste that is not handled is estimated to reach 13% of the municipal waste.

Table 10. Solid Waste Management in Mataram, 2019

No.	Description	Unit	Amount
1	Waste Generated Potential	Ton/year	119,704.05
2	Waste Reduction at Sources	Ton/year	3,977.77
	Percentage of waste reduction at sources	%	3.32
a	Reducing waste generated	%	0.91
b	Reuse waste at sources	%	2.41
c	Recycle waste at sources	%	0.00
3	Waste Treatment at City Level	Ton/year	99,970.51
	Percentage of waste treatment at city level	%	83.51
d	Separation/Collection	%	83.36

No.	Description	Unit	Amount
e	Transporting		
	Waste transporting to waste treatment	%	0.47
	Residual waste transporting to final disposal site	%	0.31
	Waste directly transporting to final disposal site	%	83.05
f	Processing	Ton/year	186.15
	Waste managed into raw materials	%	0.16
	Waste usage for energy source	%	0.00
g	Final processing	%	83.36
	Waste processed at final disposal site	Ton/year	99,784.36
4	Waste managed (2+3)	Ton/year	103,948.28
	Percentage waste managed	%	86.84
5	Untreated waste	Ton/year	15,755.77
	Percentage untreated waste	%	13.16

Source: Jakstrada Pengelolaan Persampahan in Mataram, 2019

Waste management is one priority sector in the Local Medium Term Development Plan (RPJMD) 2016 - 2021, which has a target to serve 100% of the city's area. In this regard, the Mataram government has provided 325 units of 3-wheel motorcycles which were distributed to each neighborhood (Lestari et al., 2018). This measure has an impact on the change in the garbage transportation system in Mataram. Waste transportation from TPS/depot to landfill is carried out with 36 units of dump trucks and 19 units of arm roll trucks with the capacity to transport a volume of 944 m³ -representing only the 69% of total waste (Lestari et al., 2018).

1.6.6 Water Supply

The provision of water supply in Mataram is served through Perseroda Air Minum Giri Menang (PT AMGM). This is a local water company jointly owned by Mataram (35%) and West Lombok Regency (65%). The change of company status follows the mandatory of Government Regulation No. 54 Year 2017 on Local-Owned Business Company. PT AMGM has 6 (six) water supply systems to cover: (1) all districts in Mataram, (2) Southern part of West Lombok Regency, (3) Northern part of West Lombok Regency, (4) unit of district system (IKK) in Narmada, (5) unit of district system (IKK) in Tanjung/Pemenang and (6) unit of district system (IKK) in Bayan.

The water supply system uses spring water and is divided into two service areas based on reservoir units. First, the Bug-Bug Reservoir System uses water sources from Mata Air Sarasuta, Mata Air Saraswaka and Mata Air BBI (Fish Seed Center) located in Lingsa District. Second, the Telaga Sari Reservoir System uses a water source from the Ranget Spring located in Narmada District, West Lombok Regency. Ranget springs are also used as a source of raw water for irrigation. The water discharge of Ranget springs is around 1,500L/second, with only ± 568L/second used for drinking water while the rest is for irrigation.

The number of customers provided by PT AMGM is also increasing. In 2018, the number of customers was 77,923, an increase of 18,327 customers compared to 2014 (Mataram in Figure, 2019). The volume of drinking water supplied has also raised from 16.06 million m³ in 2014 to 18.01 million m³ in 2019. The latest data shows that the coverage of piped drinking water in 2019 reached 59.2% of total households in Mataram, while the rest still originates from drilling wells and other sources. Each customer makes monthly payments according to water usage at a rate determined by the government. The fee includes the charge for environmental services which will be paid to the respective local government.

1.6.7 Wastewater

Rapid development in Mataram has created several problems, including the sanitation sector management. Various urban activities produce wastewater that must be treated appropriately to avoid environmental pollution. Based on its sources, wastewater is divided into two categories, namely domestic waste from household activities and non-domestic waste from hospitals, industrial and commercial activities. Non-domestic wastewater usually contains toxic substances and is heavily polluted. It should be treated through private-owned wastewater treatment plant before being discharged into rivers or water bodies.

Domestic wastewater is treated in two different ways with a centralized or a decentralized treatment system. A centralized system uses a series of sewer pipes, tunnels and pumps to collect wastewater and to transport it to a central treatment plant while decentralized wastewater systems convey, treat and dispose wastewater from small communities, buildings and dwellings into individual, public or private properties.

The city does not have a centralized wastewater treatment to serve the whole city's areas. There is only a centralized system to serve a new settlement area with a limited capacity. Domestic wastewater is heavily relying on the decentralized system or on the on-site water treatment, which reaches the population at 98.24%. Most households are connected to an adequate septic tank in their individual houses. Few households are still using the public community toilets. However, there is a little portion of households that still practice open defecation.

Table 11. Wastewater Treatment System in Mataram, 2019

Indicator	Value
On-Site Domestic Waste Treatment System (SPALD-S)	
% of HH connected to adequate septic tank	88,24
% of HH connected to safe septic tank	6,66
% of HH accessed to public toilets	4,83
% of HH connected to communal sanitation centre (MCK; MCK++)	0,69
% of HH connected to communal septic tanks (< 10 HH)	0,06
% of HH with inadequate individual septic tank	4,67
% of HH with open defecation	0,44
The capacity of sludge treatment plant (IPLT Kebon Kongok) (m ³ per day)	20
Centralized Domestic Waste Treatment System (SPALD-T)	
% of HH connected to mixed public toilets in settlement area	0,32
% of HH connected to Settlement-Area Waste Water Treatment Plant (IPAL)	1,44
% of HH connected to City-Wide Waste Water Treatment Plant (IPAL Perkotaan)	NA

Source: Sanitation Strategy Document of Mataram 2017-2021

1.6.8 Transportation

Roads are the main arteries for the distribution of people and goods in Mataram. Therefore, the availability of a reliable road infrastructure network become a top priority for the City's Transportation Agency. According to quality criteria, in 2018, the total length of the road network was about 369.850 km, with 79% in good condition (City Transportation Agency, 2020). Road constructions are mostly constituted by asphalt.

In 2015, there were around 1 million daily trips to/from Mataram, of which about 30 - 35% of daily trips represented internal trips, and the rest were commuter trips from West Lombok Regency. Most of them use private vehicles (90%). The number of motorized vehicles in Mataram has fluctuated in the past three years. The ownership of motorcycles is very dominant, amounting to 288,894 units or 82% of the total vehicle number (City Transportation Agency, 2020).

Mataram has one Type-A Bus Terminal, the Mandalika Terminal which has been managed by the Ministry of Transportation since 2017. The Bus Terminal function is to serve inter-provincial transport (AKAP), inter-cities within province transport (AKDP), city's transport and rural transport. With an area of 33,000 m², the Bus Terminal could accommodate the number of passengers movement of approximately 300,000 annually. The passengers' movement of origin-destination between provinces experienced a significant increase up to 47%, but inversely, the proportion of passengers movement in the province decreased by 28% (City Transportation Agency, 2020).

Public transportation has experienced declined performance in the last ten years. There is only one route of public transportation that is operationally active from 13 designated routes, namely Mandalika - Cakranegara - Mataram - Ampenan (round-trip). Meanwhile, the number and condition of city transportation fleet (yellow bemo) also continued to decline.

There are currently only 118 units (City Transportation Agency, 2020). The regional public transportation serves routes that cross two regions between Mataram and Lombok Barat Regency. At present, only five routes out of ten routes are operational.

Mataram doesn't have seaport for ship landing and transport. There used to be Ampenan seaport, but it was moved to Lembar Seaport in West Lombok Regency to serve inter-island shipping. The Ampenan Seaport could not be extended to accommodate the increasing demand of sea transportation.

1.6.9 Energy Consumption

The rapid advancement of technology makes the community more dependent on electricity, which has an impact on raising the amount of electricity consumption. The sources of electricity are coming from the Diesel Power Plants which served Lombok Island, namely PLTD Ampenan, PLTD Taman and PLTD Paokmotong.

The number of electricity customers in Mataram reached 865,849 in 2017 with 95% of them being household customers, while the remaining 5% were Social/General, Multipurpose, Government, Industry, Street Lighting, and Business (CBS of Mataram, 2018). The number of electricity consumers has increased by 10.65% from 2016.

The increasing need for electricity must certainly be accompanied by an increased supply. PT PLN, a government-owned electricity management company, has succeeded in increasing electricity production by nearly 8 times, from 1,253.3 million KWh to 9,899.1 million KWh (CBS of Mataram, 2018). The government continues to work on electrification through the construction of a Gas and Steam Power Plant (PLTGU) with a capacity of 150MW, located in the Tanjung Karang Village, in Mataram. In the future, the increasing need for energy will require both innovation and improvement of existing technology so that the needs can be met.

Besides, Mataram has conducted efforts to save electricity on the city's infrastructure. Energy efficiency, among others, is done through the replacement of conventional public street lighting with Light Emitting Diode (LED) technology. This LED has a lower power consumption but has brighter lighting. The placement of this lamp is found in several main roads with a total of 564 lighting points.

1.7 Spatial Planning and Land Cover Changes

1.7.1 City Spatial Structure and Pattern

Being the capital city and the economic centre in West Nusa Tenggara Province, Mataram plays an important role in the national, provincial and city spatial planning. The National Spatial Plan designated Mataram as the National Activity Center (PKN) which has a role as the main transportation hub to support the development of economic sectors, mainly poultry, plantation, and tourism. Meanwhile, West Nusa Tenggara Province Spatial Plan has designated Mataram Metro including Mataram and six districts in West Lombok Regency as the Provincial Strategic Area (KSP) with the following main economic sectors: trade, service, industry and tourism.

The Mataram Spatial Plan (Local Regulation No. 5 Year 2019) divides the plan of the city service centres into three categories. First, the city Service Centre (*Pusat Pelayanan Kota/PPK*) is the AMC Corridor Area which serves the regional and national economic activities. AMC stands for Ampenan, Mataram and Cakranegara. Second, the Sub City Service Centre (SPPK) serves city economic activities. There are six areas designated as SPPK. Third, the Neighborhood Service Centre (PL) is the centre at the neighborhood level to support the SPPK. There are 33 Neighborhood Services in Mataram.

Regarding patterns in land use, Mataram has experienced several changes in the last decade. Land use pattern has grown in linear, concentric and partial ways. A linear land use pattern follows the existing main road network like in the corridor of Ampenan, Mataram and Cakranegara, whereas the concentric land use pattern follows a grid road system spread out in Cakranegara area. The partial land use pattern can be observed in new settlements areas.

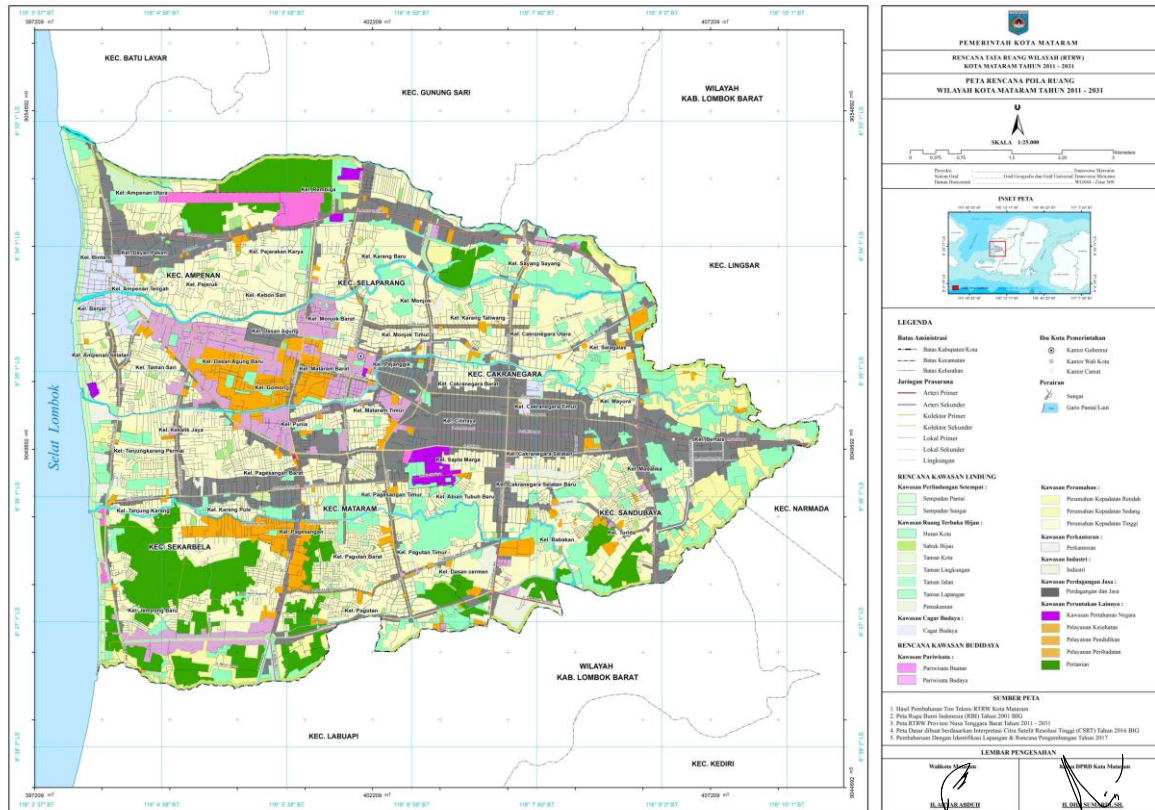
Table 12. Land Use Based on Spatial Plan 2011-2017

No.	Land Use	Land Area (ha)						
		2011	2012	2013	2014	2015	2016	2017
1	Housing	2,338.56	2,352.18	2,405.23	2,414.48	2,426.64	2,431.99	2,438.70
2	Sport Field	46.10	46.10	46.10	46.10	46.10	46.10	46.10
3	Cemetery	51.64	51.64	51.64	51.64	51.64	51.64	51.64
4	Office	115.36	115.45	115.45	115.45	116.13	116.13	116.94
5	Education	146.50	151.82	151.82	151.82	152.47	152.47	152.47
6	Health	20.95	23.37	23.37	23.37	23.62	23.90	23.90
7	Religious	63.33	63.33	63.33	63.33	63.33	63.33	63.33
8	Services	0	0.26	0.26	0.38	0,38	0.38	0.38
9	Market/Terminal	67.35	68.35	68.35	68.35	68.35	68.35	68.35
10	Shop/SPBU	97.80	101.98	102.78	104.57	104.94	106.17	106.69
11	Kiosk/Restaurant	0.40	1.06	1.55	1.56	1.56	1.56	1.56
12	Hotel	18.91	18.91	18.91	18.91	19.23	19.23	19.23
13	Warehouse	50.60	50.60	52.24	52.24	52.40	52.40	54,07
14	Industry and Service	51.75	51.75	51.75	51.75	51.75	51.75	51.75
15	City Park	6.07	6.07	6.07	6.07	6.07	6.07	6.07
16	Earmarked Land	125.32	125.82	125.88	129.88	129.88	129.88	129.88
17	Agriculture land	2,847.47	2,819.42	2,763.49	2,748.22	2,733.62	2,726.88	2,717.05
18	Non Cultivated Land	81.89	81.89	81.89	81.89	81.89	81.89	81.89
Mataram		6,130.00	6,130.00	6,130.00	6,130.00	6,130.00	6,130.00	6,130.00

Source: CBS Kota Mataram dan BPN Kota Mataram, 2018

During the period 2011 - 2017, the percentage of built up area was higher than the one of non-built up area with a surface percentage of 50 - 52%. Built up area is used for new settlements, trade and services, and urban services.

Figure 6. Map of the Spatial Pattern Plan of Mataram Area 2011-2031

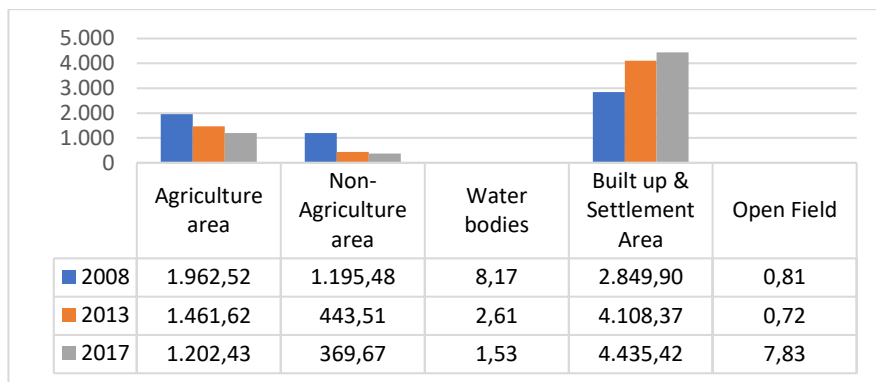


Source: Local Regulation No. 5 Year 2019 on the Revised Spatial Plan of Mataram 2011-2031

1.7.2 Land Cover Changes

Rapid urban development in Mataram makes the pattern of land use more varied, including settlements, offices, industry, and other urban facilities. In the period 2008 - 2017, land cover in Mataram has changed due to the increase of built-up and settlement areas which reached 1,585.52ha (26.35%). In addition, open space land has also increased by 7.02ha (0.12%). At the same time, there was a decrease in land cover especially on agriculture area by 760.10ha (-12.63%), non-agriculture area by 825.81ha (-13.72%), and water bodies by 6.64ha (-0.11%).

Figure 7. Land Cover Area (in ha)

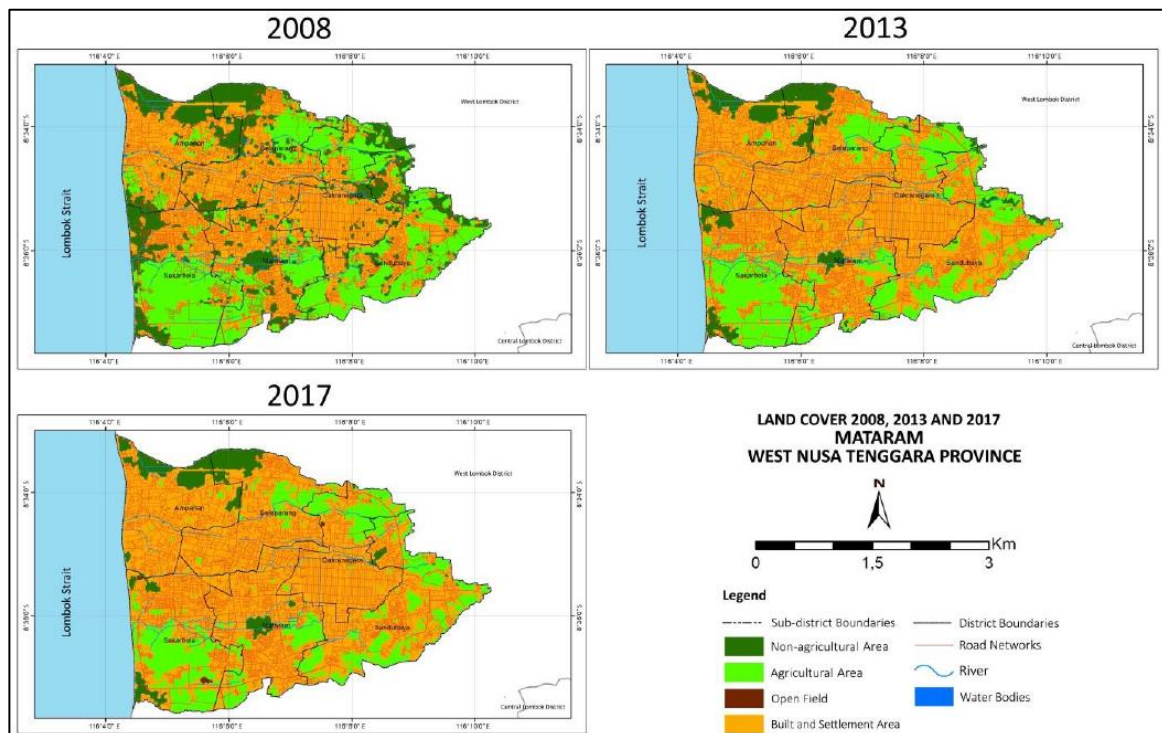


Source: Putri et al., 2019

The largest land-use changes occurred in Sandubaya Subdistrict particularly due to the changes of agriculture land into industry, warehousing, trade and services (Putra & Rudioarto, 2018). Land-use changes from agricultural land to trade and services functions have occurred in Sekarbela District (Putra & Rudioarto, 2018). These changes are affected by the construction of the Southern ring road connected to Lembar Seaport and to Lombok International Airport.

The development of Mataram as a tourism-hub city has a major influence on the physical changes of the city. The agricultural land conversion has led to an enlargement of the built-up area, which is mostly used for commerce and offices as well as factory and industry. These following maps show land cover changes in Mataram from 2008-2017.

Figure 8. Land Cover Changes in Mataram



Source: Putri et al., 2019

1.8 Disaster Risks

1.8.1 Disaster Risk Index and Major Disaster Events

The city is vulnerable to earthquakes and tsunami disasters because of the geologic position of Lombok Island in the subduction zone between two major plates of India-Australia and Eurasia. According to the National Board for Disaster Management (BNPB), Mataram is classified as high disaster risk index of 149 and ranks 302 of 496 disaster risk regency/city in Indonesia (BNPB, 2013).

Over the last 40 years, most of the earthquakes occurred in the Northern part of the island. In 2018, major earthquakes occurred at Lombok Island. There were at least six earthquake events with the highest magnitude reaching 6.9Mw, which heavily impacted the North Lombok Regency. The epicentre of the earthquake was located around 47km from Mataram. This earthquake triggered a tsunami that entered the mainland with an height of 10-13 cm in average and a maximum of 0.5 meters. It led to 460 deaths, 7,733 injured and 417,529 displaced people, as well as important damage including 71,962 housing units, 671 education facilities, 52 health facilities, 128 units of worship facilities and several infrastructure facilities, resulting in significant socio-economic impacts (Kompas.com, 2018).

Table 13. Disaster Risk Index in Mataram

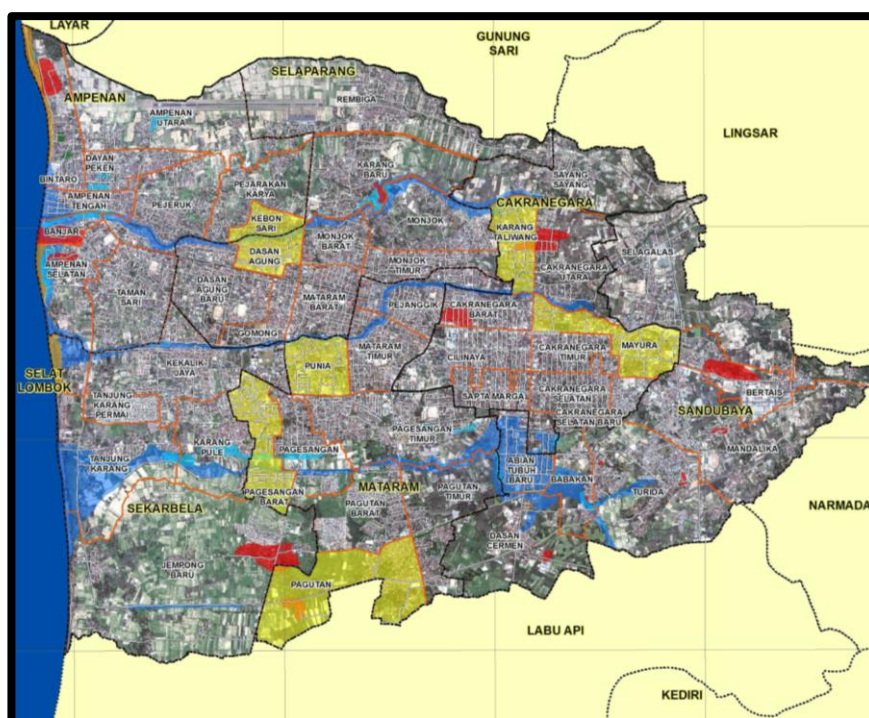
Potential Hazard	Risk
Earthquake	Medium
Tsunami	Medium
Flood	Medium
Landslide	High
Coastal abrasion	High
Forest fire	High
Drought	Medium

Source: BNPB, 2013

1.8.2 Historical Map of Disaster

Mataram has been known as a tourism destination area, but several coastal areas are located on disaster-prone areas. Beside geological disasters such as earthquake and tsunami, it also has potential for hydro-meteorological disasters such as floods, drought, tidal waves, and coastal abrasion.

Figure 9. Historical Map of Disaster



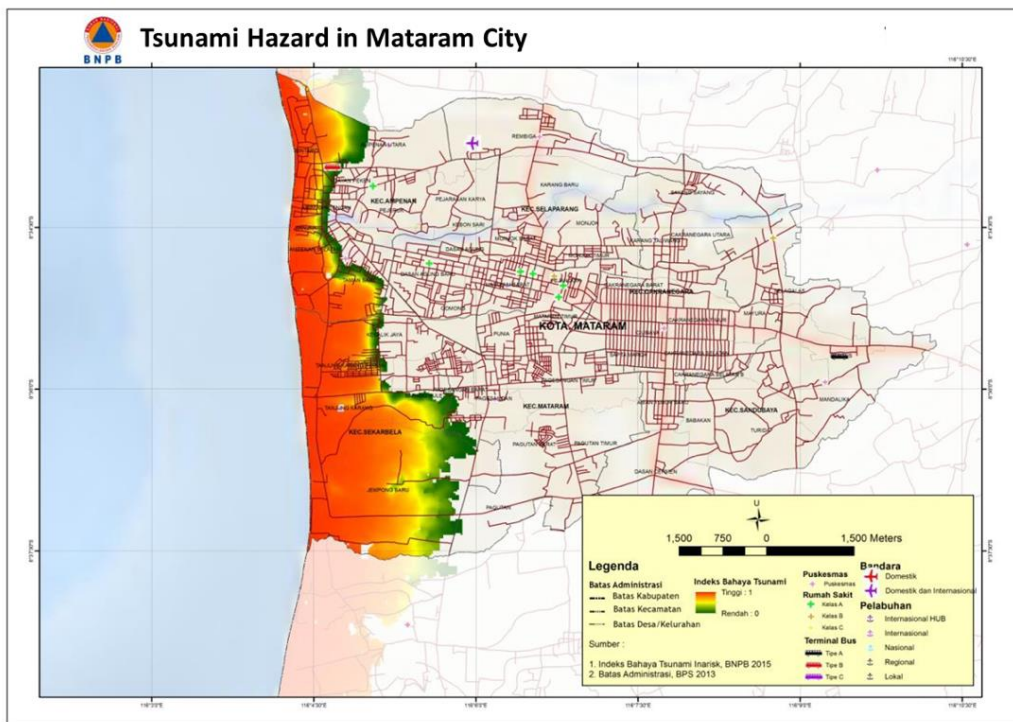
Source: BPBD, 2019

A recent assessment has been done by Rudiastuti et al. (2019), who formulated a coastal vulnerability index of Mataram with six parameters including shoreline changes, coastal slope, significant wave height, geomorphology, sea-level rise and tidal range. The assessment found that Mataram coast has a moderate to high risk of coastal vulnerability level due to geomorphology and shoreline change factors. This condition is exacerbated by the lack of coastal green infrastructures like mangrove, artificial reefs, and seagrass bed.

Coastal areas in Mataram are likely to be affected by tidal waves and tsunamis while being prone to coastal abrasion. Abrasion occurs due to the erosion of the beach by waves or high waves at a certain time continuously. One of the impacts of coastal abrasion is the occurrence of seawater intrusion, which can affect groundwater conditions in Mataram.

The topographical condition of Mataram, which is mostly flat and sloped by four major rivers, causes each watershed to be prone to landslides, especially in the rainy season. In addition to landslides, several zones, especially in the Districts of Sekarbela, Mataram and Cakranegara are often inundated and flooded. This inundation is also caused by the number of drainage channels that are not functioning optimally and the shifting of functions from irrigation channels to drainage.

Figure 10. Hazard Index for Tsunami in Mataram



Source: BNPB, 2019

1.9 Climate Change Risk and Vulnerability

In 2010, the Ministry of Environment in cooperation with GTZ PAKLIM and WWF had conducted a Risk and Adaptation Assessment on Climate Change in Lombok Island and West Nusa Tenggara Province. The goal of the assessment was to provide guidance and reference for decision-makers at the regional level in order to assess potential risks from climate change impacts and determine adaptation options.

From the assessment, it is clear that the sectors affected by climate change in Mataram include water resources, agriculture, and coastal and marine.

Table 14. Affected Sectors by Climate Change Impacts in Mataram

Sector	Hazard	High Risk Area
Water	Drought; declining water availability; floods	Mataram
Agriculture	Crop planting failure	Central Lombok; East Lombok
Coastal and marine	Sea water temperature rise; weather extreme; rainfall pattern; river flow; sea level rise	Mataram

Source: GTZ PAKLIM & WWF, 2012

1.9.1 Vulnerability Assessment

Climate change could trigger natural hazards in coastal and ocean environments such as increases in sea surface temperature, increases of frequency and intensity of extreme events (storm, cyclone); changes in rainfall pattern and river stream; changes in natural climate variabilities (El Niño, La Niña); changes in ocean circulation patterns and sea level rise (KLHK, GTZ PAKLIM & WWF, 2012).

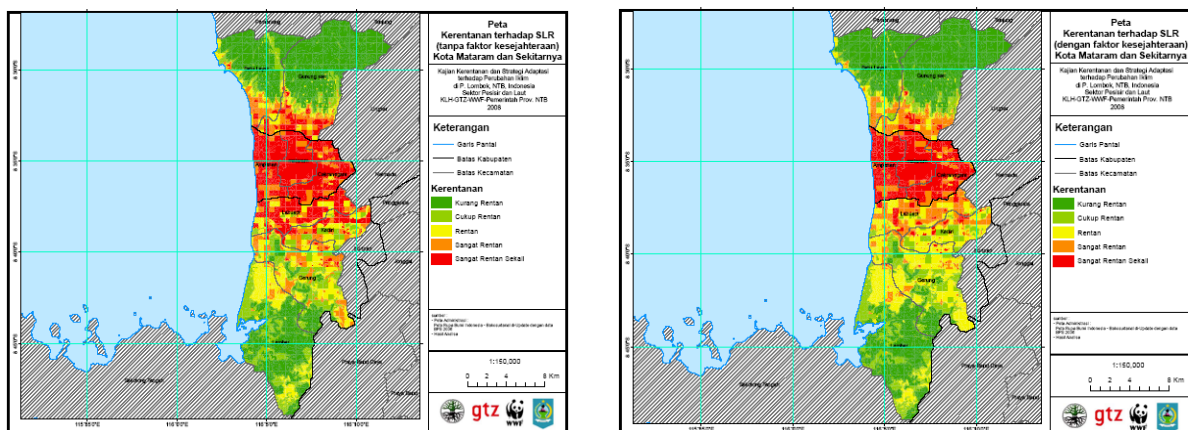
The levels of vulnerability of the coastal areas in Mataram and surrounding areas are determined by several factors, among others: population density, land use types, elevation, slopes, vulnerability of vital infrastructure and population welfare. The analysis is applied to districts in Mataram (Ampenan, Mataram, and Cakranegara) as well as in West Mataram Regency (Batu Layar, Gunung Sari, Labuanapi, Kediri, Gerung, and Lembar).

Table 15. Coverage of Vulnerability Level in Mataram

No.	Vulnerability Level	Coverage area (ha)	
		Without consideration of population welfare factor	With consideration of population welfare factor
1	Very low vulnerability	13,261.60	12,429.88
2	Low vulnerability	5,401.15	5,555.38
3	Medium vulnerability	7,224.36	5,560.73
4	High vulnerability	4,429.75	4,430.74
5	Very high vulnerability	5,826.37	8,166.52

Source: KLHK, GTZ PAKLIM & WWF, 2012

Figure 11. Vulnerability Maps of Mataram: Potential Coastal Inundation, with Population Welfare Factor (Left) and without Population Welfare Factor (Right)



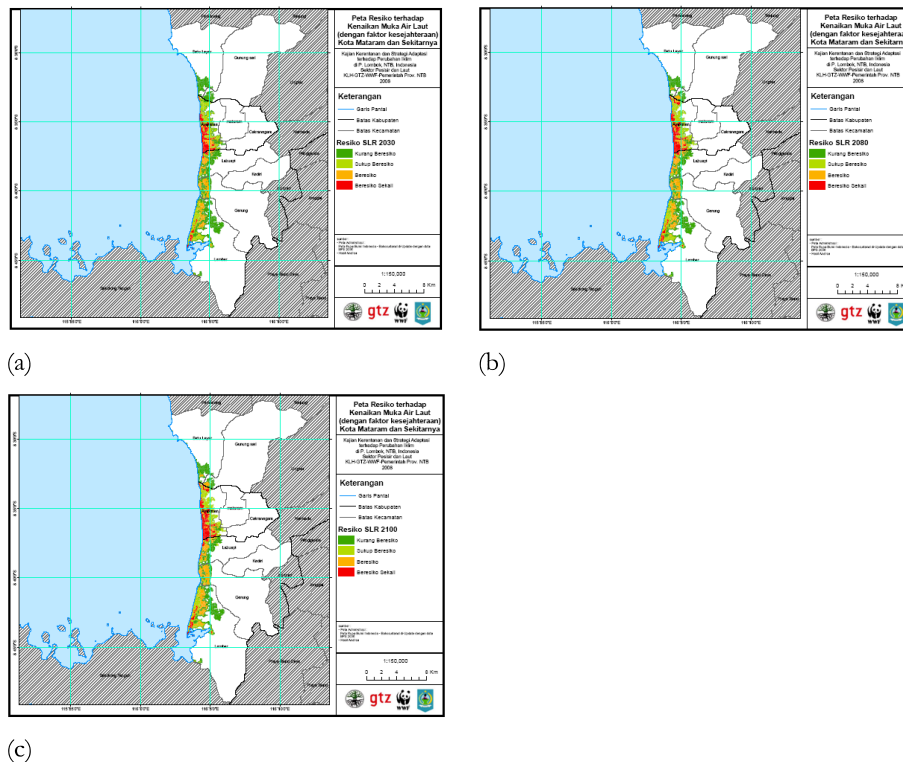
Source: KLHK, GTZ PAKLIM & WWF, 2012

1.9.2 Risks Assessment

Figure 12 shows risk levels and the coverage areas with population welfare factors in Mataram and its surroundings. It can be seen that by including population welfare factors,

medium and very high-risk areas tend to encompass a larger part of the territory. This is caused by the level of welfare of coastal communities being very low. It, therefore, increases both the vulnerability and risk exposure of several identified coastal areas. From the analysis of vulnerability and risk, a high-risk area is found in the district Ampenan, Mataram.

Figure 12. Risk Maps of Climate Change Projections for Years 2030s (A), 2080s (B), and 2100 (C) In Mataram and Its Surrounding with Population Welfare Factor



Source: KLHK, GTZ PAKLIM & WWF, 2012

Table 16. Coverage Risk Level in Mataram with and without welfare factor

No.	Risk Level	Coverage area (ha)					
		Without consideration of population welfare factor			With consideration of population welfare factor		
		2030	2080	2100	2030	2080	2100
1	Very low risk	2,230.57	1,931.37	1,871.68	1,767.82	1,481.31	1,422.2
2	Low risk	1,613.44	1,854.29	1,816.74	976.4	979.91	933,17
3	Medium risk	218.31	258.38	348.91	762.82	928.32	958.88
4	High risk	65.37	83,64	90.36	620.65	738.15	813.44

Source: KLHK, GTZ PAKLIM & WWF, 2012

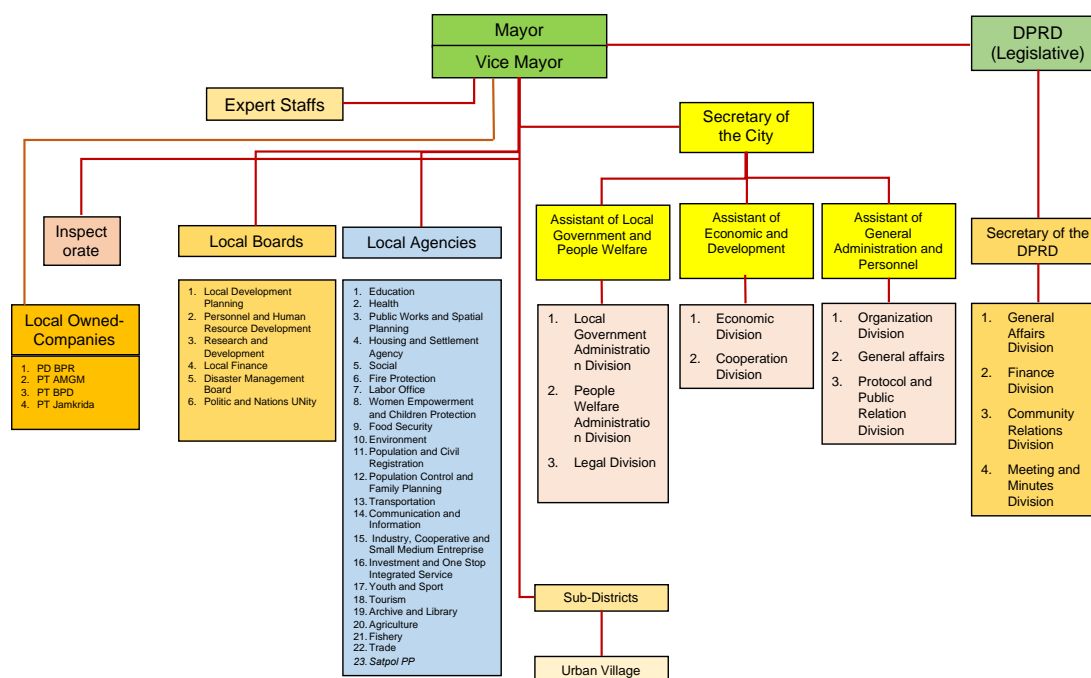
1.10 Urban Governance

1.10.1 Mataram Government Structure

Mataram Government is divided into two main elements. First, the executive element includes the Mayor, Vice Mayor and Local Government Agency (*Organisasi Perangkat Daerah*). The Mayor and Vice Mayor are political positions directly elected by the citizens every five years. The Local Government Agency in Mataram comprises the Secretary of City, the Inspectorate, 23 Local Agencies, 6 Local Boards, 6 Subdistricts and 50 Urban Villages. The City Government could establish Local-Owned Enterprises (BUMD) to support the city economic development, particularly on the types of investment which are not yet attractive for the private sector and are not covered by the obligations of the public service.

Second, the legislative element known as the Regional People's Representative Assembly (DPRD) is the people's representative institution as the element of regional administration at the city level. The DPRD is composed of the members of political parties who are elected through general election every five years. For the 2019-2024 period, the members of DPRD in Mataram are 40 people representing 12 political parties. The Chairman of DPRD mostly comes from the winning political party and is accompanied by two Vice-Chairman from other largely voted-for political parties. There is also the Secretariat of DPRD to provide administrative services to legislative members.

Figure 13. The Organizational Structure of Mataram Government



Source: Local Regulation No. 15 Year 2016

1.10.2 Local Stakeholders in Mataram

With regard to climate resilience and inclusiveness, local stakeholders in Mataram represent these categories: (1) Local Government Agency; (2) Non-Government Organization (NGOs); (3) University; (4) Professional Association; and (5) Private Sector. The detailed stakeholders identification with their tasks and potential contributions can be seen the following table.

Table 17. Stakeholder Involvement in Climate Resilience and Inclusive Policy Making

Stakeholder	Tasks and responsibilities	Potential contributions to CRIC
Local Development Planning Board (Bappeda)	Policy formulation, coordination of development planning and monitoring	Coordinating role in preparing Local Action Plan and mainstreaming Local Action Plan into the Medium Term Development Plan (RPJMD)
Local Disaster Management Board (BPBD)	Policy formulation, coordination of disaster management and monitoring	Implement disaster risk reduction activities including community awareness and Early Warning System
Environmental Agency	Develop and implement policies and programmes on environmental issues, i.e. air pollution, waste and solid waste management	Coordinating role in preparing Local Action Plan and implement activities on air pollution, waste and SWM
Settlement and Housing Agency	Develop and implement policies and programmes on water and sanitation, liveable house and slums	Implement activities on water, sanitation, housing and slums and integrate with ongoing project
Spatial Planning and Public Works Agency	Develop and implement policies and programmes on spatial plan and open green space	Mainstreaming Local Action Plan into the Spatial Plan (RTRW) and implement activities on open green space and spatial plan controlling
Transportation Agency	Develop and implement policies and programmes on transport and urban mobility	Formulate and implement sound environmental programmes to improve transport and urban mobility
Wahana Lingkungan Hidup Indonesia (Walhi) West Nusa Tenggara	Advocacy on environmental issues	Campaign and policy advocacy
World Wild Fund (WWF) West Nusa Tenggara	Advocacy on environmental issues, spatial planning	Campaign and policy advocacy
Pusat Studi Lingkungan Hidup (PSLH) University of Mataram	Learning and education; research and development and community services	Technical support to formulate Local Action Plan and community services on climate resilience
Universitas Muhamadiyah Mataram	Learning and education; research and development and, community services	Technical support to formulate Local Action Plan and community services on climate resilience

Stakeholder	Tasks and responsibilities	Potential contributions to CRIC
Indonesia Association of Planner (IAP) West Nusa Tenggara	Advisory services on city planning and environmental issues	Technical support to formulate Local Action Plan
Apindo Mataram	Implement programmes on social and environmental aspects	Engages in campaigns for environmental improvements and conducts several environmental improvement activities
Real Estate Indonesia (REI) West Nusa Tenggara	Implement programmes on social and environmental aspects	Engages in campaigns for environmental improvements and conducts several environmental improvement activities

Source: Analysis, 2020

CHAPTER 2

Policies and Strategies for Climate Resilience

2.1 National Development Policies

The Indonesian Government has committed to addressing climate change. In 2015, Indonesia submitted its post-2020 climate pledges to the UNFCCC known as Intended Nationally Determined Contributions (INDC). Since then, it has signed and ratified the Paris Agreement and later, formally submitted its first Nationally Determined Contribution (NDC) in 2016 reiterating its commitment to a low carbon, climate-resilient future. In its NDC, Indonesia committed to unconditionally reduce GHG emissions by 29% against a 2030 business-as-usual (BAU) scenario and GHG emissions by up to 41% below the 2030 BAU level, subject to international assistance for finance, technology transfer, and capacity building.

Additionally, Indonesia's NDCs also set out the framework of climate change adaptation, focusing on improving economic, social and livelihood resilience as well as ecosystems and landscapes with priority in the affected sectors of food, water and energy (Indonesia NDC, 2017). Indonesia's medium-term goal of climate change adaptation strategy is to reduce risks in all the sectors of development (agriculture, water, energy security, forestry, marine and fisheries, health, public services, infrastructure and urban systems) by 2030 through strengthening local capacity, knowledge management, the convergence of climate change adaptation and disaster risk reduction

(API-PRB) policies as well as the adoption of adaptive technologies.

Prior to the 2015 Paris Agreement, the Government of Indonesia has enacted policies and programs to combat climate change by committing to reducing goals, setting domestic sectoral targets, and passing legislation as well as regulations. Presidential Regulation of the Republic of Indonesia No. 61 Year 2011 on The National Action Plan for Greenhouse Gas Emissions Reductions (RAN-GRK) was enacted to establish the national emissions reduction target of 26% below BAU by 2020, with a further reduction of up to 41% below BAU with adequate international support.

Regarding adaptation efforts, the Ministry of National Development Planning (Bappenas) has prepared the National Action Plan on Climate Change Adaptation (RAN-API) in 2014. This plan is designed to contribute to the RPJMN 2015-2019 (National Medium-Term Development Plan). Adaptation strategy and actions have become part of a cross-sectoral program. The RAN-API strengthens endeavours on mitigation that have been formulated in the RAN-GRK.

The Government of Indonesia continues to mainstream climate change mitigation and adaptation into the National Medium-Term Development Plan 2020 - 2024. It envisions an economy that is socially inclusive and environmentally sustainable and emphasizes seven development priorities, one of them being the environment, disaster and climate change

resilience. This priority agenda elaborates into three (3) Priority Programs (PPs), namely PP-1 on Improving Environment Quality; PP-2 on Enhancing Disaster and Climate Resilience and PP-3 on Low Carbon Development. Each priority program is divided into several Priority Activities into related development sectors.

Since 2014, the Ministry of Environment and Forestry (MoEF) plays a significant role in dealing with the climate change agenda and, accordingly, has established a Directorate General of Climate Change Controlling. Its main functions concern mitigation, adaptation, reducing Green House Gases, resources mobilisation, GHG inventory, monitoring, reporting and verification of mitigation efforts as well as controlling land and forest fires. Some initiatives on climate change information system that have been developed as tools for controlling climate change which, among others, are: the Information System on the Data of Vulnerability Index (SIDIK); the Land and Forest Fires Monitoring System; the Climate Change Knowledge Centre; the Inventory System of National GHG; the Information System on National Safeguard REDD+ and the National Registry System on Climate Change Controlling.

The Ministry of Environment and Forestry has also supported the implementation of various mitigation and adaptation efforts at the provincial and at the city/regency level such as, to cite a few, the Climate Fields School to support the resilience in the agriculture sector and The Climate Village Program (Program Kampung IKLIM) to strengthen community resilience and other jointly-initiatives with sectoral ministries. Moreover, to support the implementation of GHG reduction and climate resilience efforts, the national government has newly launched an Environmental Fund Management

Agency (BPDLH). It is a public service agency that can receive and manage both state and non-state funds coming from domestic and international sources for climate change management.

Resilience to disaster and climate change risks is critical for achieving the Sustainable Development Goals (SDGs). Integrating climate adaptation and mitigation within SDGs can be beneficial for building resilience. The coherence of action to implement those frameworks can save money and time, enhance efficiency, and further enable adaptation action. The Government of Indonesia has been committed to successfully implement the Sustainable Development Goals by achieving the 2030 development agenda. The Presidential Decree No. 59 Year 2017 on the Implementation of SDGs in Indonesia was issued to provide the Roadmap of SDGs in Indonesia.

2.2 Sector Specific Policies

Integrating climate resilience at the sectoral level is important because the response options are highly sector-specific. Sectoral Ministries therefore need to assess the risks of climate change and undertake necessary measures in their respective sectors. Recent legislation, decrees, and government regulations relevant to achieving climate commitment and sectoral targets are listed and explained in this section. These policies show a significant effort to create an integrated approach to addressing climate change issues and inclusiveness in Indonesia though they have generally focused on the needs of specific sectors.

Table 18. Sectoral Policies, Plans and Programs Related to Climate Resilience

Sector	Main Policies and Plans	Flagship Programs
Air Pollution	Government Regulation No. 41 Year 1999 on Air Pollution Control Minister of Environment Regulation No. 12 Year 2010 on The Implementation of Air Pollution Control	Program Langit Biru (Blue Sky Program)
Water Pollution	Law No. 32 Year 2009 on Environment Government Regulation No. 82 Year 2001 on Water Quality Management and Water Pollution Control	The Company's Performance Rating (PROPER)
Water Supply	Law No. 17 Year 2019 on Water Resources Government Regulation No. 121 Year 2015 on Water Resource Exploitation Government Regulation No. 122 Year 2015 on Water Supply Provision System	Regional Water Supply Provision System (SPAM) Community Based Water Supply (PAMSIMAS)
Wastewater	Presidential Regulation No. 185 Year 2014 on The Acceleration of Water Supply and Sanitation Provision	Community Based Sanitation (SANIMAS)
Solid Waste Management	Law No. 18 Year 2008 on Solid Waste Management Government Regulation No. 74 Year 2001 on The Management of Toxic and Hazardous Materials Government Regulation No. 81 Year 2012 on The Management of Household Solid Waste and Other Related Household Solid Waste Presidential Regulation No. 97 Year 2017 on National Policy and Strategy on Solid Waste Management Government Regulation No. 27 Year 2020 on Specific Solid Waste Management	Clean City Program (ADIPURA)
Slum Settlement	Law No. 1 Year 2011 on Housing and Settlement Government Regulation No. 14 Year 2016 on The Management of Housing and Settlement Area	Cities Without Slums (KOTAKU)
Energy	Law No. 30 Year 2007 on Energy Government Regulation No. 79 Year 2014 on National Energy Policy President Regulation No. 22 year 2017 on National Energy Planning (RUEN) President Regulation No. 35 Year 2018 on The Acceleration of Waste Processing Plant for Environmental Based Technology Electricity Energy	Energy Efficiency Reward Initiative on New and Renewable Energy
Transportation	Law No. 22 of 2009 on Traffic and Road-Based Transportation Law No. 38 Year 2008 on Road Government Regulation No. 17 Year 2017 on Traffic and Road Transportation Safety	Bus Rapid Transit Environmentally Sustainable Transport

Sector	Main Policies and Plans	Flagship Programs
Disaster management	Law No. 24 Year 2007 on Disaster Management Government Regulation No. 21 Year 2008 on The Arrangement of Disaster Management	Indonesia All Hazard Warning Risk Evaluation (InaWARE) Disaster Resilience Village (Desa Tangguh Bencana)
Climate Adaptation	Law No. 32 Year 2009 on Environment Government Regulation No. 46 Year 2017 on Environment Economic Instruments Minister of Environment and Forestry Regulation on The Guidelines of The Assessment of Climate Impacts, Risks and Vulnerabilities (<i>Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.7/Menlhk/Setjen/Kum.1/2/2018</i>) Minister of Environment and Forestry Regulation on The Formulation of Climate Adaptation Action (<i>Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.33/Menlhk/Setjen/Kum.1/3/2016</i>) Minister of Environment and Forestry Regulation on Climate Village Program (<i>Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.84/Menlhk/Setjen/Kum.1/11/2016</i>)	Information System on the Data of Vulnerability Index (SIDIK) Climate Village Program (Program Kampung Iklim) Climate Fields School
GHG Inventory	Minister of Environment and Forestry Regulation on The Guidelines for Implementation and Reporting on GHG Inventory (<i>Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.73/Menlhk/Setjen/Kum.1/12/2017</i>)	Inventory System of National GHG
Financing	Presidential Decree No. 77 Year 2018 on Environment Fund Management	Environmental Fund Management Agency (BPDLH)

Source: Analysis, 2020

2.3 Local Policies, Plans and Programs in Mataram

Mataram has a Long-Term Development Plan (RPJPD) 2005 - 2025 enacted through the Local Regulation No. 8 Year 2008. The Long-Term Development Plan envisions the development of a religious, advanced, and cultural Mataram as the center of government, trade and services in 2025. In achieving its vision, it is pursued through seven (7) development missions, one of them is realizing the management of potential natural resources based on the principles of environmental sustainability and sustainable development. This plan elaborates into a Medium-Term Development Plan (RPJMD) following the political election every five years.

Some issues related to climate change have been partially elaborated in the Medium Term Development Plan 2016 - 2021, as the third period of Long-term Development Plan. Climate resilience is accommodated under the second mission on improving the adequate

community life through the management of spatial-based urban Infrastructure in order to achieve sustainable development. This mission has two main objectives: the first objective is the increase of the quantity and quality of housing and settlement area, which can be achieved through a comprehensive wastewater management for slum settlements, access to clean water, a regulatory framework for solid waste management, the establishment of a hierarchical solid waste management institution, the establishment of Regional Final Disposal Site (TPA Regional), waste to renewable energy as well as flood management. The second objective is concerned with the environmental quality management, which will be achieved through soil, water and air pollution control, and more green open spaces.

Detailed policies, plans and programs related to climate resilience in Mataram can be seen in the following table.

Table 19. Local Policies, Plans and Programs in Mataram

Sector	Main Policy and Regulation	Plan and Program
Air Pollution	Local Regulation No. 4 Year 2013 on Smoking Free Area	Vehicle Emission Test
Water Pollution	Local Regulation No. 13 Year 2010 on Ground Water Tax	Prokasih (Clean River Program)
Water Supply	Local Regulation stipulated by West Lombok Regency on PT AMGM (Perseroda)	Masterplan of Water Supply Provision System (RISPAM), 2015
Wastewater	Local Regulation No. 12 Year 2017 on Community Based Total Sanitation	City Sanitation Strategy (SSK) 2016-2021 Small Scale Liquid WTP - Temporary Storage for Liquid Waste (Plan International) Feasibility Study Sewerage System Development Project (SSDP) - ADB and MoPWPB
Solid waste management	Local Regulation No. 1 of 2019 on Solid Waste Management	Sister City Program with MBSA, Selangor, and Pengzhou City, Chengdu on Green Technology for Waste to Energy Implementation of Zero Waste Program through Bank Sampah (waste bank)
Open Space	Local Regulation No. 6 Year 2015 on Environmental Management and Protection Local Regulation No. 8 Year 2015 on The Management of Green Open Space	Actively participated in Green City Program for Eco District Eco-Edu Tourism
Slum Settlement	Local Regulation No. 17 Year 2016 on Slum Prevention and Quality Improvement	Slum Prevention and Quality Improvement Plan (RP2KPKP) National Flagship Program on Cities Without Slums (KOTAKU)

Sector	Main Policy and Regulation	Plan and Program
Energy		Masterplan for Smart Street Lighting (AFC & Citeos-Omexcom France)
Transport	Local Regulation No. 2 Year 2018 on Traffic Impact Analysis Local Regulation No. 7 Year 2016 on The Arrangement of Transportation	Vehicle Emission Test
Disaster management	Local Regulation No. 5 Year 2019 on The Revision of Mataram Spatial Plan 2011-2031 Local Regulation No. 10 Year 2016 on Medium-term Development Plan of Mataram 2016-2021 Local Regulation No.5 Year 2015 on Prevention and Response to Fire Hazard Local Regulation No. 4 Year 2015 on The Arrangement of Local Disaster Management	Warning Receiver System Earthquake and Tsunami Contingency Plan

Source: Analysis, 2020

CHAPTER 3

Key Challenges and Opportunities in Priority Sectors

3.1 Climate Adaptation and Disaster Risks Reduction

As said earlier, the city is not only vulnerable to earthquakes but also to harmful impacts from climate change and hydro-meteorological disasters including floods, sea-level rise, extreme waves, abrasion and drought. Most of earthquakes have occurred in the Northern part of Lombok Island. One major earthquake in 2018 devastated some areas in Mataram, heavily impacting socio-economic assets. While floods, including flash floods, are mostly caused by overflowing river water and coastal flooding due to tidal and abrasion in coastal areas.

Floods due to overflow of river water are caused by several things, including the reduction of the catchment area, the river discharge from the upstream area that exceeds the capacity of the river and the occurrence of river width narrowing caused by the utilization of the river border as a building site. Riparian settlements have encroached riverbanks and coastal areas and are characterized by the poor quality design of water infrastructure systems, while impeded drainage flows further exacerbate the flood events. In March 2018, over 1,000 houses were inundated by flash floods in Mataram. Coastal flooding is linked to low lying land along coastlines that are

exposed frequently to high tides and abrasion in the city's area.

In parallel of disaster preparedness, the Mataram Government supported by the National and Provincial Government have developed Early Warning Systems for Tsunamis and Earthquakes. A Warning Receiver System (WRS) has been recently installed by the Meteorological, Climatological and Geophysical Agency (BMKG) to disseminate early warnings for earthquakes and tsunamis. In addition, there are two tower units of sirene for tsunami warnings managed by the Provincial Disaster Agency for seven years. Early warning systems for flood disaster are not yet available.

Coordination to facilitate disaster risk reduction activities in Mataram has been carried out through the regulation and establishment of a Local Board for Disaster Management (BPBD). The disaster risk reduction has been carried out through socialization, education, coordination and consolidation strategies aimed at disaster preparedness and post-disaster recovery. Furthermore, the BPBD of Mataram has formulated a Contingency Plan for Earthquake and Tsunami Disasters comprising three aspects including: (1) Early Mitigation and Natural Disaster Victim Handling; (2) Emergency Response and Logistic Support for Disaster Response; and (3) Post Disaster Recovery.

The municipal government has initiated the mainstreaming of climate change and disaster risk reduction into the Local Medium-term Development Plan (RPJMD) 2016-2021. In the same way, disaster risk

reduction policies have been included in the Spatial Plan (RTRW) for Mataram 2011-2031 through the allocation of disaster evacuation spaces. The distribution of areas dedicated to disaster evacuation spaces is directed at open spaces, office, educational, health and religious buildings that are integrated hand in hand with disaster evacuation routes, thus allowing them to accommodate disaster victims.

3.2 Access to Drinking Water

The coverage of piped water system in Mataram reached 59.2% of total household in 2019 and is served by PT Air Minum Giri Menang (Perseroda) for Mataram and West Lombok Regency. Some residents still use groundwater sources to meet their needs for clean water. Piped water services continue to increase based on the volume of water supplied and the number of customers. However, the piped water service still faces some obstacles regarding high water leakage (non-revenue water), the continuity of services, water turbidity etc.

It is noteworthy that this water company has received several awards for its performance in service management and leadership over the last five years. PT AMGM became the first water company in Indonesia, changing its legal entity from public company (*Perusda*) to be a local-business entity (*Perseroda*). It is mandated by Government Regulation to make the water company more professional and competitive. The change of legal entity of water company was enacted under the local regulation of West Lombok Regency as the majority shareholder of water company.

Mataram Government is now under the process of revising the Masterplan of

Water Supply Provision System (SPAM) since the previous plan was formulated in 2008. The master plan outlines current needs and the conditions of water supply as well as the strategies to provide water supply in future. Besides increasing the capacity of raw water sources in Lombok Island, the West Nusa Tenggara Province is still managing the regional water supply provision system (SPAM Regional) for Lombok Island. This pipeline project will be implemented by using the public private partnership involving provincial government, local governments, and international investors. The project will serve more than half of population in Lombok Island.

With regard to groundwater extraction, Local Regulation No. 13 Year 2010 on Ground Water Tax was enacted to control the groundwater extraction, nevertheless, its effectiveness should be evaluated after ten years of its implementation. The utilization of groundwater is still high both for households and for commercial or industrial activities. The control of groundwater use has not been carried out effectively, especially to ensure the quality of groundwater.

Mataram Government could enhance the provision of water supply through several strategies namely: enhancing the performance of the local water company (PT AMGM); repairing and maintaining the existing water infrastructure; improving water continuity, quality and quantity; reforming the water tariff system and, last, improving the local stakeholders' capacity.

3.3 Sanitation and Domestic Wastewater

Wastewater and sanitation management need to be improved. The centralized sewage treatment system at the city scale does not yet exist, it is only limited to

communal waste management and has not been evenly distributed in all settlements. Most households still use individual septic tanks, and few of them are using communal toilets. To improve the sanitation condition, Mataram Government has enacted the Local Regulation No. 12 Year 2017 based on Community-Based Total Sanitation and a City Sanitation Strategy (SSK) 2016-2021. The objective of these efforts is to support the achievement of universal access of sanitation.

Wastewater and sanitation are the key components in slum alleviation plans and programs, including Prevention and Settlement Improvement Quality Plan and the City Without Slum Program (KOTAKU). Most households in slum settlements are not connected to safe and adequate sanitation. For the settlement located along riverbanks, it is also combined with the Clean River Program.

The municipal government has been involved in preparing a pipeline project in order to accelerate wastewater infrastructure investment. The city has actively participated in the Sewerage System Development Project (SSDP) initiated by ADB and Ministry of Public Works. This project designed the Liquid Waste Treatment Plant (*SPAL Terpusat*) covering 48% of city's area with the priority in slum settlements.

Inadequate wastewater management has had impacts on water pollution, including river water pollution. Mataram is crossed by four rivers, with a total length of 175 kilometers and riverbanks covered around 5,410ha. Most of them are polluted due to the lack of community awareness, waste disposal and wastewater discharge directly into the water. Much wastewater flows untreated into rivers, increasing to the pollution and severely impacting residents and local environment. The

measurement results of water quality of Jangkok River have shown that water quality is low due to pollution in the middle and downstream areas. River waters are polluted by the E.Coli and Total Coli, and that could present a threat to the community health.

The problems of river pollution are mainly caused by the lack of law enforcement on industrial wastewater discharge to the river and solid waste disposal from settlements along the riverbanks. Many urban activities -including slum settlements- are located along the riverbanks, and they use water from the river for domestic activities. Furthermore, some locations are prone to inundations, given the limited capacity of the micro-drainage system.

Mataram government should improve wastewater and sanitation management in order to reduce environmental health risks for its residents. The efforts can be made through enhancing water quality monitoring system; applying decentralized wastewater treatment systems; accelerating sewerage system development project and improving community awareness.

3.4 Solid Waste Management

Solid waste management is not yet optimal in Mataram. The amount of generated waste increases along with the development of new residential, trade and service areas. Several problems related to solid waste management among others include: the lack of waste management infrastructure, including the capacity of dump trucks to transport waste to the final disposal site and their old-age conditions; the lack of community behaviour to collect waste and their understanding on community based waste management;

the inadequation of the final disposal site and its lifetime; the waste reduction through 3R which has not been consistently implemented in the community and, last but not least, waste to energy is still a discourse that has not been yet followed up.

Mataram government has issued local policy on solid waste management which was enacted through the Local Regulation No. 1 of 2019 on Solid Waste Management. There are two different approaches of solid waste management, namely waste reduction and waste processing. This policy aims at supporting the implementation of the national policy and strategy on solid waste management, which should be achieved in 2025.

Concerning waste reduction, the city government needs to improve waste management through reducing, reusing and recycling waste (3R), as well as through composting and other resource utilization activities. The obligation to sort waste must be done at the source of waste, i.e. setting a ban on waste disposal by the open dump method in any place. Apart from the Zero Waste Program, Mataram also supported the establishment of Bank Sampah (waste banks) both in the schools and in every village. A waste bank is a place for sorting and collecting waste that can be recycled and/or reused, given their economic value potential. The existence of waste banks can reduce the amount of waste transported to landfill sites.

On waste processing, the municipal government puts a high priority on waste to energy considering their waste volume and financial capacity. Waste to energy will provide several benefits, including economic value, job opportunities, increasing electricity power and cost efficiency for transferring waste. Internally, the implementation of waste to energy can be done with the development of an

Integrated Waste Processing Site (TPST) equipped by green technology to produce pellets for power generation fuels.

At the same time, there is also an ongoing initiative from West Nusa Tenggara Province to produce pellets from waste as the fuel for electricity powerplants and/or to capture methane gases for energy sources. These activities are initially implemented in TPA Kebon Kongok using the disposal waste from Mataram and West Lombok Regency.

Some initiatives on waste reduction are ongoing such as the active promotion of waste banks and 3R's; policy support on plastic-use restriction and strengthening community capacity in waste reduction activities. Waste processing can be done through revitalising the final disposal site and by applying waste to energy schemes.

3.5 Air Pollution Control

Some of the main roads in Mataram are congested due to the use of private vehicles during peak hours, both by city residents and commuters from West Lombok Regency. This condition increases air pollution from motor vehicle emissions though the measurements of air quality have shown very good results. Some indicators on air quality are still below the standard threshold. Nevertheless, if the number of motorized vehicles steadily increases every year, the emissions will also increase, inevitably altering air quality in the future.

Air pollution control is under the authority of all levels of government starting at the national, provincial and district/city levels. Since 1999, the Ministry of Environment and Forestry has issued regulations related to air pollution control and

followed up by issuing National Air Quality Standards. Air pollution control is carried out through national programs such as the Blue Sky Program which aims to create environmentally conscious behavior from both immovable (industrial) and mobile sources, that is motorized vehicles.

The Ministry of Environment and Forestry has built 14 Air Quality Monitoring Stations in major Indonesian cities including Mataram in 2018. The AQMS stations continuously measure PM₁₀, PM_{2.5}, SO₂, NO₂, O₃, HC, and CO parameters at the respective locations. Measurements of air quality in the city of Mataram were carried out at 4 sampling locations, continuously monitoring nitrogen dioxide (NO₂) and sulfur oxide (SO₂); however, data on carbon monoxide (CO), ozone (O₃) and particulate matters PM₁₀ and PM_{2.5} are not collected.

The increasing number of motorized vehicles has affected air quality in Mataram. The Environment Agency conducts motor vehicle emission testing as part of air pollution control efforts. Vehicles that do not pass the emissions test are generally of old age and in poor maintenance. Afterwards, these vehicles are given a recommendation to carry out routine and periodic maintenance so that the exhaust gas is in accordance with the quality standard.

As a part of the efforts to improve air quality in Mataram, the systematic air pollution monitoring system should be established as a collective effort between Mataram Government and West Nusa Tenggara Provincial Government. The coordination among all levels of government can strengthen the expansion of sampling locations for air quality measurement and improve cooperation on data sharing with various government agencies. For example, real-

time data can be shared with the Health Agency to improve public health services.

It is very important to control air pollution in the framework of climate change mitigation. The most dominant source of greenhouse gas emissions comes from the transportation sector and the energy that is generated from urban areas. In addition to improving a more systematic air quality measurement system, air pollution control in the City of Mataram can be carried out through efforts to increase environmental awareness of urban residents and promote low carbon development pathways.

Finally, there are several initiatives that need to be encouraged: motor vehicle emissions tests; intensifying the measurement and monitoring of air pollution originating from immovable sources (industries, settlements and offices); encouraging the implementation of car-free days on main city roads on certain days; and promoting the use of non-motorized vehicles, for example providing special lanes for pedestrians and bicycles.

3.6 Sustainable Use of Resources: Green Open Spaces

The city has experienced massive land-use changes from agriculture and non-agriculture land into built-up settlement areas in the last decade. If this trend continues, there will be an important lack of green open space in the city. These conditions have contributed to environmental problems such as the increase of surface temperature in urbanized and built-up areas. Land-use changes also hinder the target achievement of 30% green open space as mandated by city's spatial plan.

Local Regulation No. 8 Year 2015 on The Management of Green Open Space has

been issued to guide the provision of green open spaces by the public and the private sector. There are also several initiatives undertaken by stakeholders to promote more open green spaces, for instance, the Green City Program (PKH), greening and tree planting, eco-education and urban farming.

The municipal government should promote green open space initiatives involving local stakeholders through the following activities: allocation of a budget for land acquisition, development of eco-education, policy support and capacity-building for local stakeholders.

CHAPTER 4

Recommendations for Priority Sectors

This section briefly describes proposed recommendations for priority sectors with regard to climate resilience and inclusive city. These recommendations have been developed based on the analysis of priority sectors and existing policies, plans and programs. Types of recommendations are divided into three categories including: instrument and tools; policy, regulation and document; and capacity-building.

4.1 Climate Adaptation and Disaster Risks Reduction

- Develop Early Warning System (EWS) for flooding during the rainy season
- Develop the Multi-Hazard Warning Receiver System (WRC)
- Establish climate projection modelling
- Support land use policy to enhance city resilience (zoning for disaster and other hazards)
- Formulate the contingency plan on flooding and other hazards
- Enforce the Contingency Plan for earthquakes and tsunamis
- Coastal community-based preparedness
- Technical capacity on vulnerability and risk assesment (VRA) and asset inventory

4.2 Access to Drinking Water Supply

- Repairment of networks (JDU, JDP, JDS, SR)
- Customer reporting/complaint system
- Improved 3C in piped water supply (PDAM)
- Water tariff restructuration
- Cost recovery water tariff (Local Regulation)
- Water tariff based on classification and water consumption rate
- Controlling groundwater volume extraction and maintaining groundwater balance
- Applying clean water and drinking water fulfilling quality standard
- Improving the capacity of local-owned water company in financial management and PPP schemes
- Increasing community and industrial awareness and capacity in controlling groundwater extraction

4.3 Sanitation, Wastewater and Surface Water Quality

- Renew water quality monitoring system

- Apply the decentralized wastewater treatment system in settlement
- Enforce the provision of wastewater treatment system for industry and housing estate
- Support the acceleration of a sewerage system development project
- Community awareness on healthy and clean lifestyle (PHBS)

4.4 Air Pollution Control, Transportation and Energy

- Expansion of the AQMS stations
- Promote pedestrian and bicycle lanes equipped by green and environmental-friendly areas
- The use of IT for systematic and real-time air quality monitoring system
- Car Free Days
- Smart street lighting
- Solar panel promotion
- Policy/regulation on air pollution control and strengthening urban air quality standard
- Development of Bus Rapid Transit (BRT)
- School Carpooling
- Strengthening Vehicle Emission Tests
- Formulation of policy/regulation on energy efficiency and renewable energy

- Strengthening the capacity of community in Blue Sky Program through promoting Non-Motorized Vehicle (NMT)
- Blue Sky Program awareness
- Capacity-building on energy efficiency and renewable energy

4.5 Solid Waste Management

- Renewal/revitalizing FDS
- Promoting Waste Bank and 3R's
- Waste to energy
- Policy on plastic-use restriction
- Support the acceleration of solid waste processing investment including waste to energy
- Strengthening the management capacity of the waste banks
- Training for the informal sector and waste cooperatives
- Technical training on waste to energy
- Strengthening the capacity of women group in waste management on Collecting waste to Waste Bank; Making Eco Enzyme; Composting; Biopore; Liquid Organic Fertilizer (POC)

4.6 Sustainable Use of Resources

- Extend the area of green open space (RTH) through land acquisition for RTH
- Develop eco-education areas

- Policy on the provision of 30% RTH and tree planting in government-office areas, university and housing estates
- Policy on public open green space including cemetery areas
- Improving the capacity of community in urban greening and environment

4.7 Green House Gases Inventory

- Provide a standardized GHG emission measurement system
- Support for the GHG Inventory
- Improving technical capacity on GHG emission inventory
- Improving the capacity to utilize the GHG inventory results for controlling emissions and integration into development planning

4.8 Financing

- Toolkit for investment prioritization
- Integrating planning and budgeting
- Improving technical capacity on investment proposal development
- Training on prioritization and Pre-Feasibility Study (FS).

Table 20. Recommendations of Priority Sectors in Mataram

Output CRIC	Sector	Policy/ Regulation/ Document	Program/ Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/ Regulation/ Document	Capacity Building (CB)
Climate Resilience/ Early Warning System	Climate Adaptation and Disaster Risk Reduction	Local Regulation No.5 Year 2015 on Prevention and Response to Fire Hazard Local Regulation No. 4 Year 2015 on The Arrangement of Local Disaster Management	Warning Receiver System Earthquake and Tsunami Contingency Plan	City Vulnerability, Risk and Impact Assessment of Climate change is yet available. Early Warning System for Flooding	Early Warning System for flooding (rainy season) Multi-Hazard Warning Receiver System (WRC) Climate projection modelling	Strong land use policy to enhance city resilience (zoning) Formulate the contingency plan on flooding and other hazards Enforce the Contingency Plan for earthquakes and tsunamis	Coastal community-based preparedness Vulnerability and risk assessment (VRA) and asset inventory
	Access to Drinking Water	Masterplan of Water Supply Provision System (RISPAM), 2008 Local Regulation No. 13 Year 2010 on	Local Regulation on Local-Owned Company on Water Supply (Peruosda) PT AMGM has followed GR No. 54 Year 2017 Pipeline project on PPP for Regional	Access to piped water supply reached 59.2% High non-revenue water and continuity of services of piped drinking water	Repairment of networks Customer reporting/complaint system Improved 3C in piped water supply (PT AMGM)	Water tariff restructuring Cost recovery water tariff (Local Regulation) Water tariff based on Classification and water consumption rate	Improving the capacity of local-owned water company in financial management and PPP scheme

Output CRIC	Sector	Policy/ Regulation/ Document	Program/ Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/ Regulation/ Document	Capacity Building (CB)
		Ground Water Tax	Water Supply Provision in Lombok Island	Groundwater extraction without water quality monitoring fullfilled quality standard		Controlling groundwater volume extraction and maintaining groundwater balance Applying clean water and drinking water fullfiling quality standard	Increasing community and industrial awareness and capacity in controlling groundwater extraction
	Sanitation and Surface Water Quality	Local Regulation No. 12 Year 2017 on Community Based Total Sanitation City Sanitation Strategy (SSK) 2016-2021	Clean River Program Plan for Prevention and Settlement Improvement Quality (RP2KP) City Without Slum Program (Kotaku) Small Scale Liquid WTP - Temporary Storage for Liquid Waste (Plan International) Feasibility Study Sewerage System Development	Water quality of Jongkok river in Mataram is lightly polluted Communal IPAL is not yet available in many settlements Domestic wastewater infrastructure is not connected, only in few settlements	Renew water quality monitoring system Apply the decentralised wastewater treatment system in settlement Enforce the provision of wastewater treatment system for industry and housing estate	Support the acceleration of sewerage system development project	Community awareness on healthy and clean lifestyle (PHBS)

Output CRIC	Sector	Policy/ Regulation/ Document	Program/ Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/ Regulation/ Document	Capacity Building (CB)
			Project (SSDP) - ADB and MoPWP				
Air Pollution and Energy Efficiency	Air Pollution Control and Transportation	Local Regulation No. 4 Year 2013 on Smoking Free Area Local Regulation No. 2 Year 2018 on Traffic Impact Analysis Local Regulation No. 7 Year 2016 on The Arrangement of Transportation	Vehicle emission test for individual transport Vehicle emission test for Logistic Transport Air Quality Monitoring (AQMS) Passive Sampler Monitoring Blue Sky Program Campaign	Policy/regulation on air quality control is not yet available Limited coverage of AQMS	Expansion of AQMS station Promote pedestrian and bicycle lanes equipped by green and environmental- friendly areas The use of IT for systematic and real- time air quality monitoring system Car Free Days	Policy/regulation on air pollution control and strengthening urban air quality standard Development of Bus Rapid Transit (BRT) School Carpooling Strengthening Vehicle Emission Test	Strengthening the capacity of community in Blue Sky Program through promoting Non-Motorized Vehicle (NMT) Blue Sky Program awareness
	Energy		Energy-saving for street lighting Masterplan for Smart Street Lighting (AFC & Citeos-Omexcom France)	Policy/regulation on energy efficiency is not yet available	Smart street lighting Solar panel promotion	Formulation of policy/regulation on energy efficiency and renewable energy	Capacity building on energy efficiency and renewable energy

Output CRIC	Sector	Policy/Regulation/Document	Program/Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/Regulation/Document	Capacity Building (CB)
Waste Management	Solid Waste Management	Local Regulation No. 1 of 2019 on Solid Waste Management	<p>Sister City Program with MBSA, Selangor, and Pengzhou City, Chengdu on Green Technology for Waste to Energy</p> <p>Implementation of Zero Waste Program through Bank Sampah (waste bank)</p> <p>Pellet from waste as the fuel for electricity powerplant and capturing methane gases for energy source</p>	<p>Solid waste processing at Final Disposal Site (FDS) is still open dumping, limited controlled landfill</p> <p>Waste to energy is only in piloting</p>	<p>Renewal/revitalizing FDS</p> <p>Promoting Waste Bank and 3R's</p> <p>Waste to energy</p>	<p>Policy on plastic-use restriction</p> <p>Support the acceleration of solid waste processing investment including waste to energy</p>	<p>Strengthening the management capacity of waste banks</p> <p>Training for the informal sector and waste cooperatives</p> <p>Technical training on waste to energy</p> <p>Strengthening the capacity of women group in waste management; Collecting waste to Waste Bank</p> <p>Making Eco Enzyme; Composting; Biopore and Liquid Organic Fertilizer (POC)</p>
Sustainable Use of Resources	Green open space	Local Regulation No. 6 Year 2015 on Environmental Management	<p>Provision of Green Open Space (RTH)</p> <p>Eco-Education Movement</p>	Limited green open space (RTH)	Extent the area of green open space (RTH) through land acquisition for RTH	Policy on the provision of 30% RTH and tree planting in government-office areas; university and	Improving the capacity of community in urban greening and environment

Output CRIC	Sector	Policy/ Regulation/ Document	Program/ Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/ Regulation/ Document	Capacity Building (CB)
		and Protection Local Regulation No. 8 Year 2015 on The Management of Green Open Space	Greening and Tree Planting Movement	Land use changes (more built up area)	Develop eco- education areas	housing estates Policy on public open green space including Cemetery areas	
Green House Gases (GHG) Inventory	Inventory of GHG Emissions			GHG Inventory is not yet available Lack of data on GHG emission Limited technical capacity	Provide a standardized GHG emission measurement system	Support for the GHG Inventory	Improving technical capacity on GHG emission inventory Improving the capacity to utilize GHG inventory result for controlling emission and integrating into development planning
Financing	Financing	Financing scheme through PPP (KPBU)		Lack of technical capacity in investment proposal preparation	Toolkit for investment prioritization	Integrating planning and budgeting	Improving technical capacity on investment proposal development

Output CRIC	Sector	Policy/ Regulation/ Document	Program/ Activity	Gap Analysis	Recommendation		
					Instrument and/or Tools	Policy/ Regulation/ Document	Capacity Building (CB)
							Training on prioritization and Pre-FS

CHAPTER 5

Conclusions

This urban analysis report's aim is to develop a knowledge base on critical areas in Mataram with regard to disaster management, climate change adaptation and mitigation, solid waste management, energy and transport as well as water and sanitation. It comprises the status, problems, challenges and opportunities in each priority sectors. The report can be used as an initial scoping for the preparation of Local Action Plan (LAP).

A study on the climate vulnerability and risk assessment of the Lombok Island including Mataram and its surrounding areas was carried out by MoE, WWF and GIZ. The result shows that the sectors most affected to climate change are water resources and coastal areas. Further study should be done to update and elaborate on the impacts of climate change into the urban sector. The proposed study becomes the basis for the preparation of the Strategy and Action Plan in the Local Action Plan (LAP).

In addition, Mataram does not have a GHG inventory to estimate all emissions and removals of greenhouses gases from given sources in a specific period of time. The GHG inventory's goals are: (1) to understand the link between environmental pollution and effects to sources of pollution; (2) to identify the sectors, sources, and activities responsible for greenhouse gas emissions; and (3) to help the development of cost-effective mitigation policies.

The formulation of the LAP should be linked with the substance of the Strategic Environmental Assessment (SEA) from the Medium Term Development Plan (RPJMD) and become the input for preparing a first Technocratic Draft of the RPJMD in Mataram; to form the City Team, as well as to engage with multi-stakeholders and design collaborative processes in the LAP preparation. The City Team needs to appoint/select the Technical Team, which will be the core team for the formulation of the local Action Plan (LAP).

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