Plastic Waste in Southeast Asia

Urban Case Studies

CLOSING
THE LOOP

Acknowledgements

Contents

1. Introduction

Closing the Loop: Scaling up Innovation to Tackle Marine Plastic Pollution in Cities.

Closing the Loop by the United Nations ESCAP in partnership with the Government of Japan aims to **reduce the environmental impact of cities in ASEAN by addressing plastic waste pollution in the marine environment**. In support of the **ASEAN framework of Action on Marine Debris** and the **G20 Osaka Blue Vision**, the project will make plastic waste management more circular and reduce the amount of waste entering the marine environment.

Over the next year Closing the Loop has two broad objectives:

- To develop an innovative digital tool that allows local governments to monitor and visualise plastic waste and identify hotspots with a view to improving management.
- To work with each city to develop action plans, policies and investment strategies to address marine plastic litter.

Closing the Loop welcomes our four partner cities (Figure 1):

- **Da Nang**, Viet Nam
- **Kuala Lumpur**, Malaysia
- **Surabaya**, Indonesia
- **Nakhon Si Thammarat**, Thailand

City Profiles

This report introduces each city context with the aim of helping local and regional partners identify their common challenges, strengths, and opportunities for knowledge sharing. Profiles are structured as follows:

- **City Overview**
- **Environment** *(Geography, Natural Resources, Climate Change)*
- **Services** *(Waste Management, Digital Readiness, Water Provision)*
- **Society** *(Population, Land Use, Development, Urban Challenges)*
- **Economy** *(Production and Growth, Key Industries, Covid-19 Impact)*
- **Governance** *(National Structures, City Structures, Transboundary Considerations)*
- **Key Plans, Policy and Regulation** *(Urban, Environmental, Sustainable Development Goals)*
- **Key Stakeholders** *(Governing Institutions, International Projects and Donors, Private Sector)*

Further Information

To stay up to date with the Closing the Loop Project and view all our resources and publications please visit our website: https://www.unescap.org/projects/closing-the-loop.

Additionally for more information on the work of the Sustainable Urban Development Section, please contact: escap-edd-suds@un.org.

Figure 1. Regional overview.

Da Nang at a Glance

Da Nang City is the transport, education and commercial hub of central Viet Nam. It is governed by the Da Nang People's Committee.

Population

Da Nang Province

1.1

million

Density

856

person/km²

Central Viet Nam

East Coast

Province Area

1,285km²

Human Development Index

City **0.803**

National **0.752**

Da Nang Skyline

Satellite Overview

National Recycling
10-15%

Plastic Waste
14-17%

Total MSW Production
1100
tonnes/day

Operators:
URENCO

National GDP
$245bn

City GDP
$3.12bn

City GDP pc.
$3,059

2.7%
Agriculture

61.7%
Services

34.7%
Industry / Construction

Vu Gia - Thu Bon Basin

10,318km²

Han River
Cu De River

Risks:
Urban Flooding
Water Pollution
Salination

Policy

Urban Development:
Developing Da Nang - an Environmental City.

Environment:
Law on Environmental Protection 2014.

Waste Management:
National Strategy of Integrated Solid Waste Management up to 2025, vision towards 2050. National Action Plan for Marine Litter by 2030.

Transboundary Issues

Da Nang and Quang Nam River Basin Organisation

Hoi An City

Upstream Hydropower
Dak Mi 4, Song Bung 2, Song Bung 4, A Vuong 1, Song Con 2

Kuala Lumpur at a Glance

Kuala Lumpur is the capital of Malaysia. It is governed by Kuala Lumpur City Hall.

Population

Kuala Lumpur Federal Territory

1.8
million

Greater Kuala Lumpur

7.8
million

Peninsular Malaysia

Central West Coast

City Area
243km²

Human Development Index
City 0.860
National 0.804

National GDP
$358bn

7.1% Agriculture

57.7% Services

34.1% Industry / Construction

City GDP
$50bn

City GDP pc.
$11,373

Klang River Basin

1,342km²

Klang River + 10 Tributaries

Risks:
Urban Flooding
Soil Erosion
Water Pollution

Kuala Lumpur Skyline

Satellite Overview

Plastic Recycling **11.4%**

Plastic Waste **24%**

Total MSW Production
3739
tonnes/day

Operators: SWCorp Alam Flora

Policy

Urban Development:
Kuala Lumpur City Plan 2020-2040 draft. Eleventh Malaysia Plan 2016-2020.

Environment:
National Policy on the Environment 2002.

Waste Management:
Solid Waste Management Act 2007. Malaysia Roadmap toward Zero Single-Use Plastic 2018 – 2030.

Transboundary Issues

The Klang intersects 7 Local Authorities

Upstream
Batu Dam, Klang Gates Dam

Downstream
Shah Alam City, Klang City.

Surabaya at a Glance

Surabaya is the second largest city in Indonesia. It is the regional centre for development, trade and culture in East Java and managed by Surabaya City Government.

Population

City
3.15 million

Density
9,497 person/km²

East Java Province

Madura Strait

City Area
326 km²

Human Development Index
City **0.822**
National **0.707**

Surabaya Skyline

Satellite Overview

Waste Diversion Rate
15.3%

Plastic Waste
16%

Total MSW Production
1512 tonnes/day

Operators: >200 Community Waste Banks

National GDP
$1.04 trillion

13% Agriculture

45% Services

41% Industry / Construction

City GDP
$38.4 bn

City GDP pc.
$12,190

Brantas River Basin

11,800 km²

Kali Mas + Jagir River

Risks:
Urban Flooding
Water Pollution
Seasonal Drought

Policy

Urban Development:
Spatial Planning of Surabaya 2009-2029.

Environment:
Surabaya Water Quality and Pollution Management Master plan.
Act No. 32/2009 concerning Environmental Protection and Management.

Waste Management:
Plan of Action on Marine Plastic Debris 2017-2025.

Transboundary Issues

Brantas River Basin Management Corporation (PJT I)

The Brantas River intersects 15 regencies and municipalities.

Upstream
Gunungsari Dam, Jagir Dam

Nakhon Si Thammarat at a Glance

Nakhon Si Thammarat is the capital and largest city in Nakhon Si Thammarat Province. It is managed by the local city government.

Population

City
102,152
person

Density
4,528
person / km²

Southern Thailand

East Coast

City Area
22.6 km²

Human Achievement Index
City 0.616
National 0.622

National GDP
$543.7 bn

Province GDP
$5.28 bn

Province GDP
$3,508 pc.

8.1% Agriculture

56.9% Services

35% Industry / Construction

Water Resources

Expansive City Canal Network

>50 Irrigation and Flood Mitigation Projects since 1974

Risks:
Urban Flooding
Coastal Erosion
Water Pollution

Nakhon Si Thammarat Skyline

Satellite Overview

Plastic Waste
37%

Provincial Recycling
9%

Total MSW Production
230 - 300
tonnes/day

Operators: Local Administrative Organisations (LAOs)

Policy

Urban Development:
Nakhon Si Thammarat Provincial Development Plan

Environment:
Enhancement and Conservation of National Environmental Quality Act. 1992

Waste Management:
National Solid Waste Management Masterplan 2016 – 2021.
Roadmap on Plastic Waste Management 2018 – 2030.

Transboundary Issues

51% of city landfill is imported from nearby municipalities.

Canals link to Pak Phanang District

2. Da Nang, Viet Nam

2.1 Overview

Da Nang City is the transport, education and commercial hub of central Viet Nam. It is the main driver of the regional economy and has experienced rapid growth in recent years. Between 2000 and 2007 GDP increased an average 12% per year[1] and its position along the East-West Economic Corridor (EWEC) means increasing connectivity and investment is expected. Da Nang is reliant on its large tourism, information technology and manufacturing sectors which are combined with a young and growing work force. At present, it is the 5th largest city in Viet Nam with a population of approximately 1.1 million.

Da Nang is a coastal city, situated on the Hàn and Cu De rivers. The wider hydrology is defined by the monsoon climate and tributaries of the transboundary Vu Gia - Thu Bon basin[2]. Seasonal fluctuations in upstream precipitation are a major control on flood and drought risk across Da Nang.

The city is subject to considerable attention from international donors and investors, so far completing development projects in the public transport, disaster resilience, solid waste, and energy sectors. Present waste management capacity is limited and there is little understanding of the plastic sources, sinks and pathways in Da Nang. Closing the Loop looks to make significant contributions in this area and help strengthen city-wide waste management practices.

Figure 2. Da Nang City, satellite overview.

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[1] Ostojic, Dejan R. Bose, Ranjan K. Krambeck, Holly Lim, Jeanette Zhang, Yabei. *Energizing Green Cities in Southeast Asia*. The World Bank, 2013. https://doi.org/10.1596/978-0-8213-9837-1.

[2] Ribbe, Lars, Viet Trinh, Firoz Abm, Anh Nguyen, Uyen Nguyen, and Alexandra Nauditt. 'Integrated River Basin Management in the Vu Gia Thu Bon Basin', 153–70, 2017. https://doi.org/10.1007/978-981-10-2624-9_10.

2.2 Environment

Location: South Central Coast, Viet Nam

Area: 1,285km^2

Climate System: Tropical Monsoon

Average Yearly Precipitation: 2075mm/year (30 – 533mm/month)

Natural Resources

Water

Da Nang city is situated in the northeast Vu Gia – Thu Bon river basin[3]. Originating in the highlands of Quang Nam to the south, the Vu Gia – Thu Bon river basin covers an area of 10,318km^2 and feeds the coastal floodplains of Da Nang and Hoi An. This river basin plays an extremely important role in the life and socio-economic development of Quang Nam province and Da Nang city. The largest river in Da Nang is the Han, which flows through the city centre to discharge into Da Nang bay. It is fed by the Cau Do and Vinh Dien rivers[4]. Managing plastic pollution in the Han estuary will be a priority for the 'Closing the Loop' project.

The Cu De River catchment to the north is much smaller, only 425km^2, but still provides an important water supply. Other water features include over 546ha of surface water and extensive irrigation canal networks in the rural areas to the south and northwest.

Flow rates into Da Nang are strongly affected by seasonal precipitation and the operation of 10 upstream hydropower reservoirs. This creates significant economic and public health risks. During the wet season upstream storms can create extensive flooding, while in the dry period low flows risk compromising supply for the primary Cau Do water treatment plant[5].

Forests

Da Nang has 67,150ha of forest cover, concentrated in the West and Northwest regions. Alongside their economic value these areas have a rich biodiversity. Approximately 21,000ha have been designated for environmental conservation.

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[3] Vu Gia Thon Bon Information Centre, 2020. http://www.basin-info.net/river-basins/vu-gia-thu-bon-information-centre-Viet Nam/hydrology
Figures: JICA, 2010. 'The Study on Integrated Development Strategy for Da Nang City and Its Neighbouring Area in Viet Nam (DaCRISS)'
[4] Climate Change Coordination Office (CCCO) Da Nang, 2014.
https://ccco.danang.gov.vn/106_121_1203/The_river_network_of_Danang_city.aspx
Figures: JICA, 2010. 'The Study on Integrated Development Strategy for Da Nang City and Its Neighbouring Area in Viet Nam (DaCRISS)' https://openjicareport.jica.go.jp/pdf/12014940_01.pdf
[5] ISET-International, CCCO Da Nang, CVIWR, 2016. 'Climate Change implications for Da Nang surface water management'

Source: 1:10,000 Topographic Map, 2006, DONRE.

Figure 3. Da Nang water resource map. Source: JICA, 2010

Minerals

Da Nang has a range of mineral reserves including slate, granite, aggregates and clays[6].

Climate Change

Climate change is expected to amplify existing water security pressures in Da Nang. Sea level rise, saline intrusion and an increasing frequency and severity of floods and typhoons pose major challenges to development[7].

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[6] CCCO Da Nang, 2014. https://ccco.danang.gov.vn/106_121_1150/Natural_resources_of_Da_Nang_City.aspx
[7] Rockefeller Foundation, 2016. 100 Resilient Cities Report, Da Nang http://www.100resilientcities.org/strategies/da-nang/

Source: 1:10,000 Topographic Map, 2006.

Figure 4. Da Nang elevation map. Source: JICA, 2010

2.3 Services

Waste Management

City waste management services are operated by the Da Nang Urban Environment Company (URENCO). Informal actors such as independent waste pickers, junk shops and scrap collection facilities also make a key contribution. Service coverage has improved over time and averages 75% across all districts[8].

The majority of collected waste is disposed at Khanh Son landfill in Lien Chieu district. This site manages 750 tonnes per day and is predicted to reach maximum capacity by the end of 2020[9]. In response, a $97m treatment complex is in development for Hoa Nhon commune, 15km to the south-west. This aims to process 1,500 tonnes per day and operate under a public-private partnership[10]. Key waste management challenges in Da Nang include: inadequate infrastructure, limited technical capacity, weak value chains for recycling and a lack of data and monitoring.[11]

Total solid waste generation: 1100 tonnes/day[12]

% Plastic waste: 14[13]-17%[14]

Total plastic waste generation: 150 tonnes/day

Digital Readiness

In 2019 Da Nang Province was ranked first in the Vietnam ICT Index for the 11th consecutive year[15]. This is the result of consistent investment in technical infrastructure, human resources and IT uptake across the city. Unique features include: a provincial open data policy, a comprehensive e-governance platform offering >1000 public services, and free public wifi along many of the city's roads and public spaces[16].
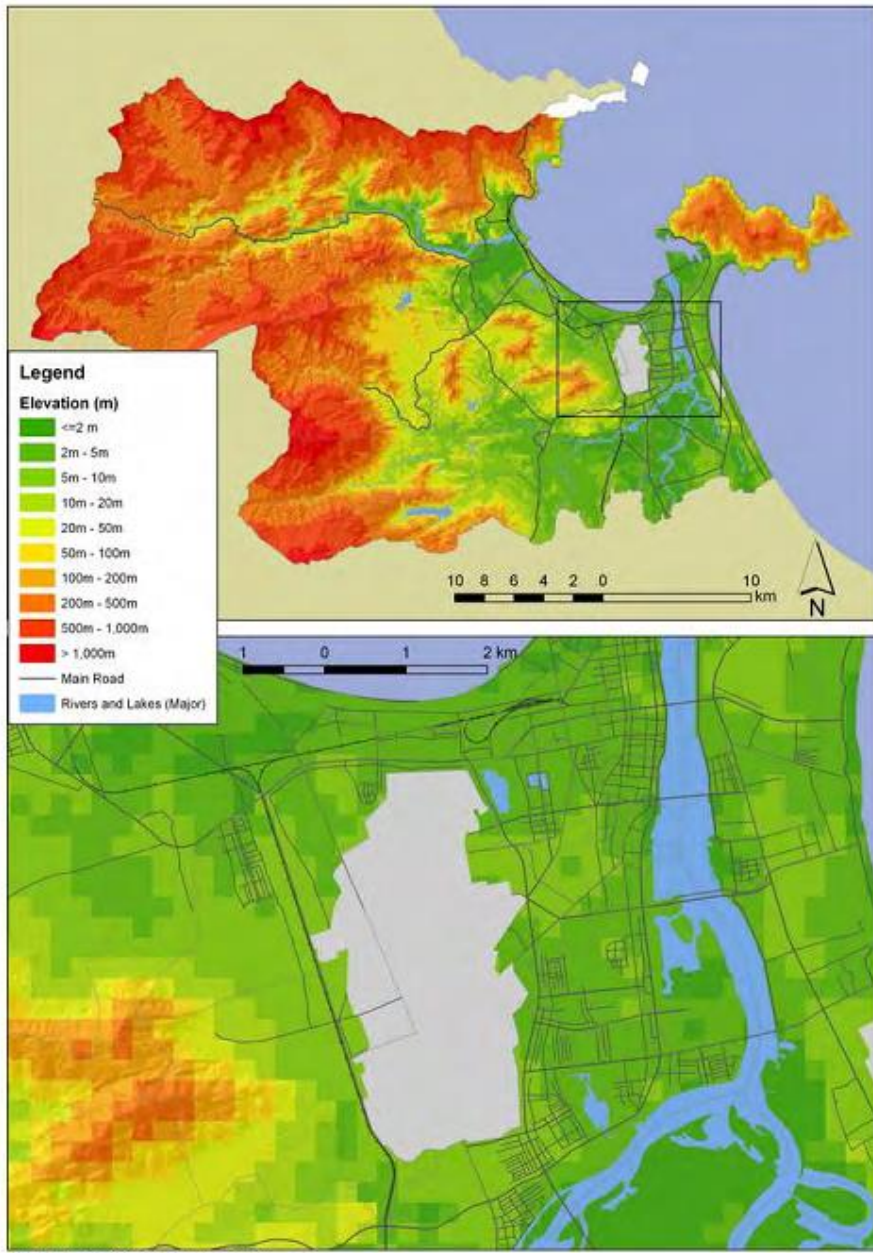
National Index Score[17]: 12.06/25

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[8] Vetter-Gindele, et at., 2019. 'Assessment of Household Solid Waste Generation and Composition by Building Type in Da Nang, Viet Nam'. *Resources* 8, no. 4:171. https://doi.org/10.3390/resources8040171.
[9] Asian Development Bank, 2017. 'ADB Helping Da Nang City Develop Waste Treatment Solutions Using PPPs'. https://www.adb.org/news/adb-helping-da-nang-city-develop-waste-treatment-solutions-using-ppps.
[10] Da Nang IPA, 2017. 'Investment Opportunities Presentation'. https://home.kpmg.com/content/dam/kpmg/vn/pdf/publication/2017/Invest%20in%20Da%20Nang%202017_English.pdf
[11] USAID, 2020. 'Case Study: Behavior Change in Local Systems to Mitigate Ocean Plastic Pollution'.
[12] URENCO, 2019.
[13] GIZ, 2018. 'Waste Management in Da Nang, Viet Nam at Khanh Son Landfill Hoa Nhon landfill', GIZ Urban Nexus Report
[14] Ibid: Vetter-gindele 2019
[15] Government of Viet Nam, 2019. Viet Nam ICT Index 2019 ranking results. http://egov.chinhphu.vn/danh-gia-muc-do-san-sang-ve-chinh-phu-so-va-du-lieu-mo-a-NewsDetails-37750-1883-186.html
[16] Department of Information and Communication, 2015. 'Da Nang City from e-government to smart city' https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2015/August-eGov2015/Session-3/S3_Hoai_Duc_Nguyen.pdf
[17] Cisco, 2019. Digital Readiness index 2019 https://www.cisco.com/c/m/en_us/about/corporate-social-responsibility/research-resources/digital-readiness-index.html#/

Global Digital Readiness Rank: 70

Global Networked Readiness Rank[18]: 63

Water Provision

Municipal water supply for Da Nang City is provided by the Da Nang Water Supply Company (Dawaco), which is mainly reliant on surface water from Cau Do River in the south of the city. The intake point on Cau Do River for Cau Do Water Treatment Plant is about 15km from the river mouth and often affected by saltwater intrusion during the dry season with salinities of over 1000 mg/l.

Water services and infrastructure in Da Nang have significantly expanded in recent years. Since 2007 urban coverage has increased from 52% to 93% in 2017, while non-revenue water dropped from 39% in 2007 to 15% in 2017[19].

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[18] Portulans Institute & World Information Technology and Services Alliance (WITSA), 2019. Networked Readiness Index Ranking 2019. https://networkreadinessindex.org/

[19] Wright-Contreras et al., 2020. 'Water operators' partnerships and their supporting role in the improvement of urban water supply in Da Nang', *International Journal of Water Resources Development*, 36:1, 1-26, DOI: 10.1080/07900627.2019.16257

WASTE COLLECTION

The Urban Environment Company (URENCO) collects household and business waste daily and transfers it to landfills. At the household level, households bag their waste and keep it outside their homes for collection by URENCO staff. Although the formal waste collection system via URENCO covers most of the waste collection in Da Nang, an estimated 8 to 10 percent of waste is collected by the informal system, through a network of independent waste collectors (IWCs). They may collect waste from households with whom they have a personal relationship and then deposit it at transfer stations.

FORMS OF COLLECTION

- Door-to-door collection from households
- Collection on main streets using trucks
- Collection from bins placed at roadsides

WASTE SEPARATION

While Da Nang has relatively high coverage rates for waste collection, waste separation is a challenge and is governed by a largely informal system that separates high-value materials for resale and sends the remainder to landfills. Most waste separation occurs after URENCO staff and IWC collect waste. Waste separation is not a formal function of URENCO, although recent regulation requires separation at source. Economic incentives motivate URENCO staff to separate and recycle waste (staff can resell high-value recyclables.) IWCs also separate and recycle to boost income.

TREATMENT

• RECYCLING

URENCO staff and IWCs connect with agents to sell separated plastic materials for recycling. IWCs deal closely with smaller agents who depend on larger agents for the sale of plastic goods. These larger agents generally have the trucks and workers for a broader scale of operation, moving recycled materials to other parts of the country for treatment.

Prices for recycled materials fluctuate based on international and domestic changes.

• LANDFILLING

Landfilling is the primary method of waste treatment in Da Nang. URENCO transports waste items not recycled to landfills for disposal. The city's landfills are not designed for separate disposal of organic and inorganic waste, and they currently operate beyond maximum capacity.

FINANCING SOLID WASTE MANAGEMENT SERVICES

- URENCO is funded by fees paid by households and businesses.
- The city determines the price per quantity of waste collected, and URENCO enters into waste collection contracts with businesses based on that price.

Source: Case study interview data

Figure 5. Summary MSW management process in Da Nang. Source: USAID, 2020.

2.4 Society

Viet Nam's urban population has been rapidly expanding and reached 34 million in 2018[20]. By 2050, 57% of people are expected to live in urban areas[21]. Therefore, the provision of good quality housing, management of environmental pollution, and improving human capital will be key challenges for city managers in coming decades.

Da Nang has a population of around 1.1 million over approximately 270,000 households[22]. Approximately 88% of residents live in the 6 urban districts with 12% in the more rural regions. Population densities can be as high as 19,712pp/km^2 with most citizens residing in 2-5 story shophouses[23]. Outside the city the rural districts are agrarian and sparsely populated (180 people/km^2).

Da Nang has a rich cultural history and is situated in close proximity to several UNESCO sites such as the Imperial City of Hue, Hoi An Old Town, and My Son Sanctuary. Several expansive sandy beaches present a further tourist attraction.

City Population: 1.1m, 4.1% annual growth.[24]

Average Population density: 856 people/km^2

Da Nang Human Development Index: 0.803[25]   (0.752 national[26])

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[20] UN, 2018. Revision of World Urbanisation Prospects, https://population.un.org/wup/

[21] Ibid: UN, 2018

[22] Calculated assuming 4.1 average Da Nang household size (Ministry of Planning and Investment General Statistics Office, 2009. Age-sex structure and marital status of the population of Viet Nam. https://www.gso.gov.vn/Modules/Doc_Download.aspx?DocID=13287).

[23] Vetter-Gindele, Jannik, Andreas Braun, Gebhard Warth, Tram Thi Quynh Bui, Felix Bachofer, and Ludger Eltrop. 'Assessment of Household Solid Waste Generation and Composition by Building Type in Da Nang, Viet Nam'. *Resources* 8, no. 4 (December 2019): 171. https://doi.org/10.3390/resources8040171.

[24] General Statistics Office of Viet Nam, 2018. 'Socioeconomic Statistical Data of 63 Provinces and Cities' https://www.gso.gov.vn/default_en.aspx?tabid=515&idmid=5&ItemID=19612

[25] UNDP, 2015. 'Viet Nam Human Development report on inclusive growth' http://www.hdr.undp.org/sites/default/files/nhdr_2015_e.pdf
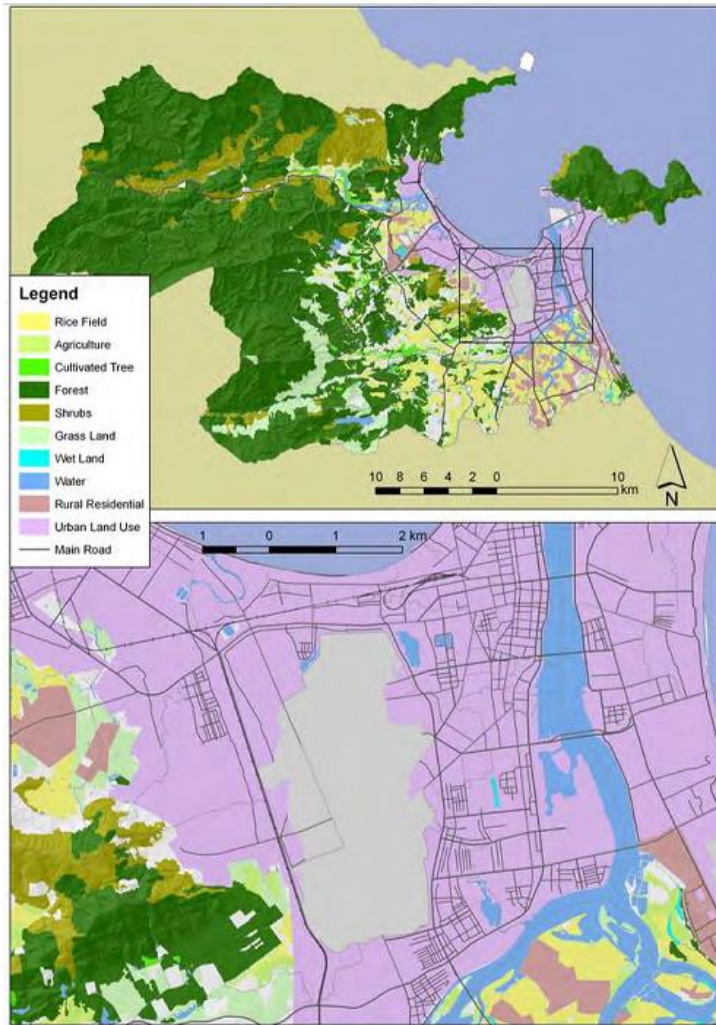
[26] Ibid: UNDP, 2015.

Note: Based on a 1:10,000-scale topographic map from DONRE, the DaCRISS Study Team classified the land uses.

Figure 6. Land use in Da Nang Province. Source: JICA, 2010.

Note: Based on a 1:10,000-scale topographic map from DONRE, the DaCRISS Study Team classified the land uses.
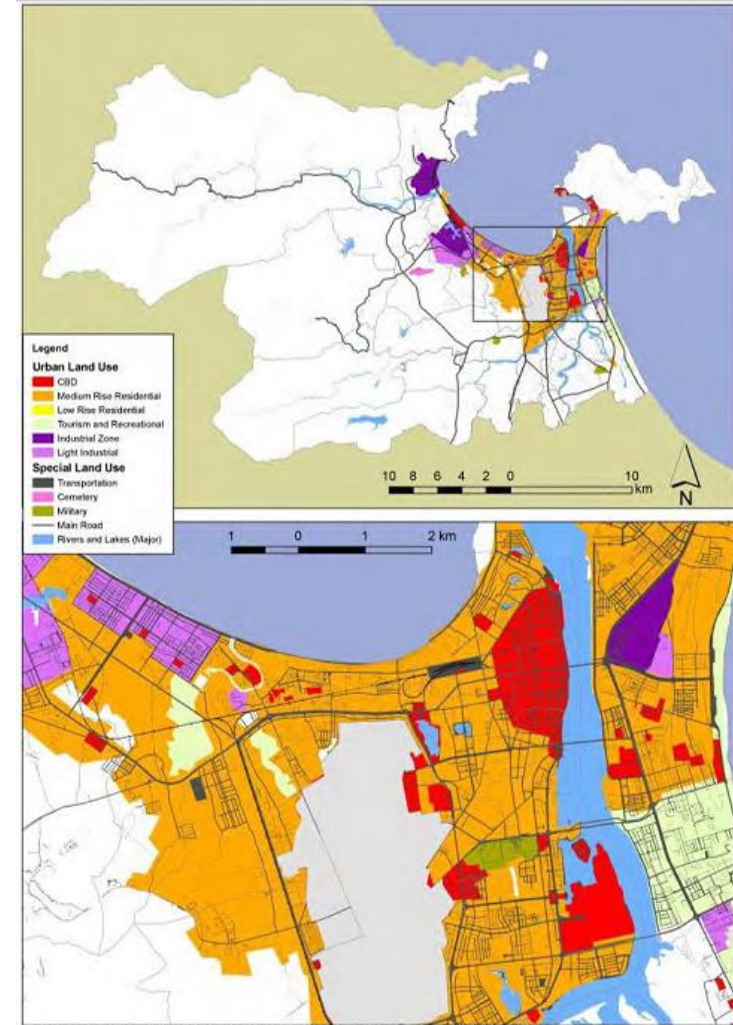
Figure 7. Urban land use in Da Nang City. Source: JICA, 2010.

2.5 Economy

National

Viet Nam is the 6th largest economy in Southeast Asia. It experiences annual economic growth of around 7%, and has seen a 4x increase in per capita GDP since 1990[27]. By 2050 Viet Nam is projected to be one of the world's fastest growing economies, averaging 5% per year[28]. Ongoing improvements in living conditions, life expectancy and literacy rates are expected to continue.

The 2020 COVID crisis has increased short-term economic and social uncertainty with national growth expected to drop to 2.7% this year. However, recent IMF projections expect economic growth to strongly rebound to 7% by 2021[29].

GDP: $245bn[30]

GDP per capita: $2,567

Economy by Sector:	Agriculture – 2.7%	Industry/Construction - 34.7%
(2019)	Services – 61.7%	

City

Da Nang experiences even faster growth than the national average. Between 2000 and 2007 GDP grew at 12.3% per year and while this was initially driven by a strong industrial and construction sector, Da Nang has now transitioned into a majority service economy. Tourism, IT, tech and finance drive economic activity as Da Nang establishes itself as an international transport and tourism hub[31]. As such, development indicators show better quality of life in Da Nang than both the surrounding rural provinces and the national average. It is expected that by 2020, GDP of Danang's service sector will account for 55.6%, industry and construction 42.8%, and agriculture accounts for 1.6%. The proportion of city GDP will account for 2.8% of the national GDP. Meanwhile, GDP per capita aims to reach 4,500 - 5,000 USD by the end of 2020[32].

Due to its strategic location, economic incentives and growing work force, Da Nang is subject to large sums of foreign private investment. As of 2019 Da Nang had registered 812 international investment

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[27] World Bank, 2019. 'Viet Nam Development Report 2019' http://documents.worldbank.org/curated/en/817501579101801852/Viet Nam-Development-Report-2019-Connecting-Viet Nam-for-Growth-and-Shared-Prosperity

[28] PWC, 2017. 'The World in 2050' https://www.pwc.com/gx/en/issues/economy/the-world-in-2050.html

[29] IMF, 2020. World Economic Outlook, April 2020: The Great Lockdown, https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/World-Economic-Outlook-April-2020-The-Great-Lockdown-49306

[30] World Bank, 2020 National Accounts Data. https://data.worldbank.org

[31] Ostojic, Dejan R. Bose, Ranjan K. Krambeck, Holly Lim, Jeanette Zhang, Yabei. *Energizing Green Cities in Southeast Asia*. The World Bank, 2013. https://doi.org/10.1596/978-0-8213-9837-1.

[32] Danang UPI, 2013. 'Final Report – Adjusted Master Plan of Da Nang City to 2030 and a Vision to 2050'.

projects, representing over $3.47bn[33]. Industrial zones are centred along the North-West bay area with further activity found on the eastern bank of the Han River. The city's business districts and high density residential zones can be found on the western bank. Additionally, several large technology, science and business parks are in the planning stages.

GDP: $3.12bn[34]
GDP per capita: $3,059

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[33] Ministry of Planning and Investment, 2019. 'Da Nang Continues Drawing More Investment'
http://www.mpi.gov.vn/en/Pages/tinbai.aspx?idTin=45932
[34] VCCI, 2017. Investment Guide to the Central Region of Viet Nam.
https://home.kpmg.com/content/dam/kpmg/vn/pdf/publication/2017/Investing%20in%20Central%20VN%20review%20file.pdf

2.6 Governance

National

Viet Nam is divided into 63 provinces with 5 centrally-administered cities. Viet Nam is a single-party republic and administered under the 2003 Law on the Organisation of People's Councils (HDND) and People's Committees (UBND). In practice this relates to a 3-tier governance structure: provincial, district, and local (ward/commune). Decision-making is hierarchical with administrative bodies directed and accountable to those above them.

City

Da Nang is one of the 'Class-1' designated cities under central administration. Da Nang is composed of 8 districts.

6 Urban: Hai Chau, Thanh Khe, Son Tra, Ngu Hanh Son, Lien Chieu, and Cam Le.

2 Rural: Hoa Vang, Hoang Sa (islands).

56 Local: 45 Wards (Urban), 11 Communes (Rural).

The Da Nang People's Committee is chaired by Mr. Huynh Duc Tho and based in Hai Chau district. There are 22 city departments and agencies across Da Nang.

Transboundary Considerations

Upstream hydropower reservoirs: Dak Mi 4, Song Bung 2, Song Bung 4, A Vuong 1, Song Con 2.

Da Nang and Quang Nam River Basin Organisation[35]

This is a joint coordination committee established in 2017 following a mutual agreement between Da Nang City and Quang Nam Province. They aim to promote cooperation between the two provinces and implement Integrated Water Resource Management (IWRM) in the Vu Gia – Thu Bon Basin to help guide economic development and improve social security and ecological safety. The committee meet every six months and are hosted by each province rotationally.

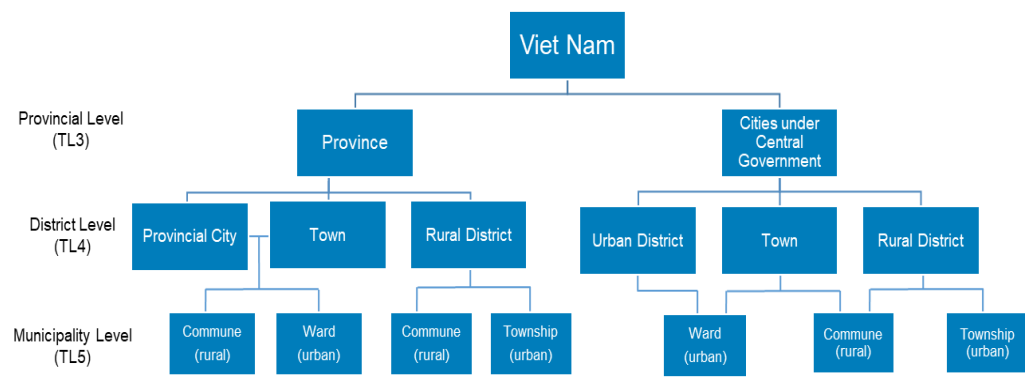35 ISET-International, CCCO Da Nang, CVIWR (2019) 'Transboundary River Basin Management in Central Viet Nam'
https://www.preventionweb.net/publications/view/66652

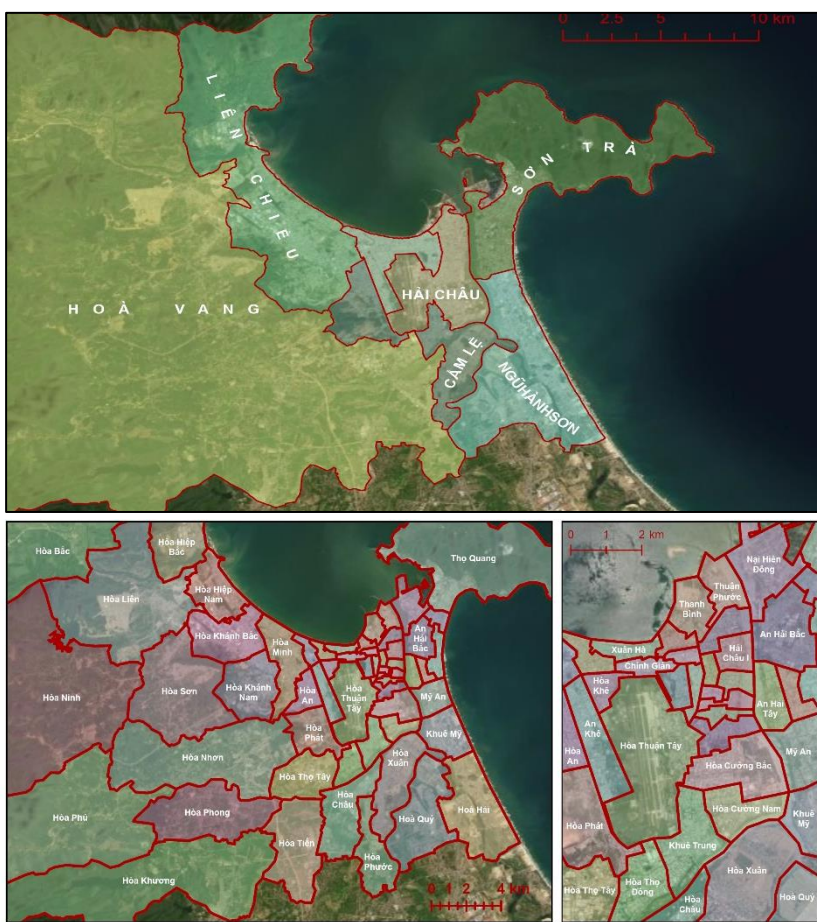**Figure 8.** Viet Nam national governance structure.

Figure 9. Da Nang district and local level administrative boundaries.

2.7 Key Plans, Policy and Regulations

Current policy and investment priorities include: managing further expansion and land use change, improving transport connectivity and traffic flow, and developing water services and waste management[36].

Urban Development

Developing Da Nang – an Environmental City Plan.

Provides a vision for city development for the period of 2008-2020. The major goals are to: (i) Prevent environmental pollution in residential areas, nature conservation areas and key tourist areas; (ii) improve the quality of water, soil, air; (iii) improve management capacity of environmental protection; and (iv) raise public awareness on environmental protection.

Viet Nam Socio-Economic Development Strategy 2011-2020.

Defines national development targets and trajectory up to 2020 and produced by the Ministry of Planning and Investment.To be updated with a 2021-2030 plan by the 13th national congress.

Danang City Socio-Economic Development Master Plan toward 2020.

This aligns national socio-economic targets with Da Nang's city planning and presents the urban development agenda to 2020. Goals include 100% wastewater treatment and 70% solid waste recycling by 2020.

Adjusted Master Plan for Socio-Economic Development of Da Nang City Towards 2020, with a Vision to 2030

In March, 2020, Prime Minister Nguyen Xuan Phuc signed Decision No. 393 approving adjustments to the 'Da Nang City Socio-Economic Development Master Plan toward 2020'. The adjusted master plan focuses on developing 3 primary pillars: tourism, high-tech industry and marine economy.

Da Nang City Master Plan for Solid Waste Treatment until 2030, Vision to 2050

Promulgated under a People's Committee Decision in 2016, Da Nang has set the target to achieve 100% domestic solid waste collection and treatment by 2030. Treatment by recycling, reuse, energy recovery and composting aims to reach 90% and 95% by 2030 and 2050 respectively. Full waste segregation must also be achieved across the whole city during this same period.

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[36] World Bank, 2013. Da Nang Sustainable City Development Project. https://projects.worldbank.org/en/projects-operations/project-detail/P123384?lang=en

Environment

Law on Environmental Protection. 2014

Viet Nam's primary environmental law presenting statutory guidelines on environmental protection, measurement and resource use. Includes provisions on climate change and international cooperation,

National Strategy for Environmental Protection 2010-2020.

Defines national pollution prevention, environmental protection and biodiversity targets to 2020, with a vision to 2030. Targets include 95% urban solid waste collection and 85% reuse/recover/recycle by 2020. Produced by the Ministry of Natural Resources and Environment and to be updated with a 2021-2030 policy, currently in draft stages.

Law on Marine and Island Resources. 2015

Defines the rights, obligations and responsibilities for stakeholders managing marine and island resources. Includes a master plan on coastal resource use, pollition control and outlines marine monitoring and surveillance.

Law on Water Resources. 2012

Addresses the management, protection, exploitation and use of water resources. Mandates the development of national and local master plans to prevent and mitigate water pollution.

National Action Plan for Management of Marine Litter by 2030.

National plan produced in alignment with the ASEAN marine debris framework. Developed by the Ministry for Natural Resources and Environment, UNDP and Norwegian Embassy.

Targets by 2025: 50% reduction in marine plastic litter, 80% of Marine Protected Areas (MPAs) to be free of plastic litter, establish monitoring across Viet Nam's 5 major drainage basins.

Targets by 2030: 75% reduction in marine plastic litter and 100% of MPAs to be free of plastic litter.

Sustainable Development Goals

National Action Plan for the Implementation of the 2030 Sustainable Development Agenda. 2017

SDG 11.6: Reduce the Adverse environmental impacts on people in urban areas, including by strengthening management of air quality, urban waste and other sources of waste.
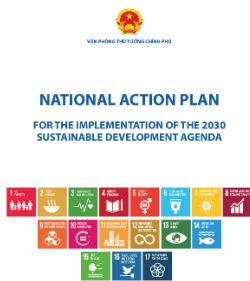
Lead agency: Ministry of Construction.

SDG 12.5: By 2030, substantiallly reduce waste generation and increase the economic value of water resources through prevention, reduction, recycling, reuse, and recover of energies from waste treatment.

Lead agency: Ministry of Natural Resources and Environment; Ministry of Consruction.

SDG 14.1: By 2030, prevent, significantly reduce and successfully control marine pollution of various forms, particularly pollution from land-based activities, including solid waste, waste water and organic substances pollution.

Lead agency: Ministry of Natural Resource and Environment.

2.8 Key Stakeholders

Governing Institutions

People's Committee of Da Nang City

Department of Natural Resources and Environment (DoNRE)

Department of Planning and Investment (DPI)

Department of Construction (DoC)

Department of Agriculture and Rural Development (DARD)

Urban Environment Company (URENCO)

Urban Construction Planning Institute

Wharf/Dock Management Authority

International Projects and Donors

IUCN – Marine Plastics and Coastal Communities Project.

WWF – Plastic Smart Cities Initiative.

USAID – Integrated Waste Management Plan; Clean Cities, Blue Ocean.

JICA – Partnership Program on Solid Waste Management, Project for Promoting Segregation and Recycling in Da Nang City.

UNDP – Scaling Up a Socialised Model of Domestic Waste and Plastic Management.

The Research Institute for Development (IRD) – Creating an Observatory for Measuring Occurrences in Society and Environment (COMPOSE)

Non-Governmental Organizations

Viet Nam Plastics Association (VPA)

Centre for Environment and Community Research (CECR)

Center for Consultancy on Sustainable Development (C4SD)

Pacific Environment – Vietnam Zero Waste Alliance
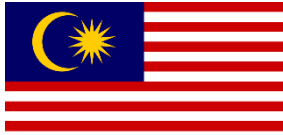
GreenViet

Greenhub

Private Sector

DANAPLAST – Danang Plastic Joint Stock Company

Coca Cola (Ekocenter in Da Nang City)

Coin for Change

Packaging Recycling Organization (PRO)

3. Kuala Lumpur, Malaysia

3.1 Overview

Kuala Lumpur is the capital and largest city in Malaysia. It has a GDP of approximately $50bn, contributing 16% of national production. Kuala Lumpur's main economic outputs include: tourism, finance, electronics manufacturing and construction. The city economy regularly grows 6-7% per year, outpacing the national average of 5% (2011-2018). Kuala Lumpur is home to 1.84m people[37], with 7.8m living in the greater urban conurbation.

Kuala Lumpur is located in the Klang Valley Basin in Peninsular Malaysia. The Klang and Gombak Rivers converge in the city centre before flowing through Selangor State and discharging downstream into the Straits of Malacca. Managing flood risk and water pollution are major transboundary challenges for Kuala Lumpur.

The Kuala Lumpur City Hall is responsible for city governance and development. Urban policy priorities include further investment in human capital, the development of public infrastructure (particularly transport and waste infrastructure) and encouraging sustainable economic growth.

Closing the Loop will be working with district and state-level government alongside private and NGO actors to manage plastic pollution and leakage in the Klang River. Present data on plastic pollution is limitted so there is considerable scope to further understanding of plastic waste in Kuala Lumpur.
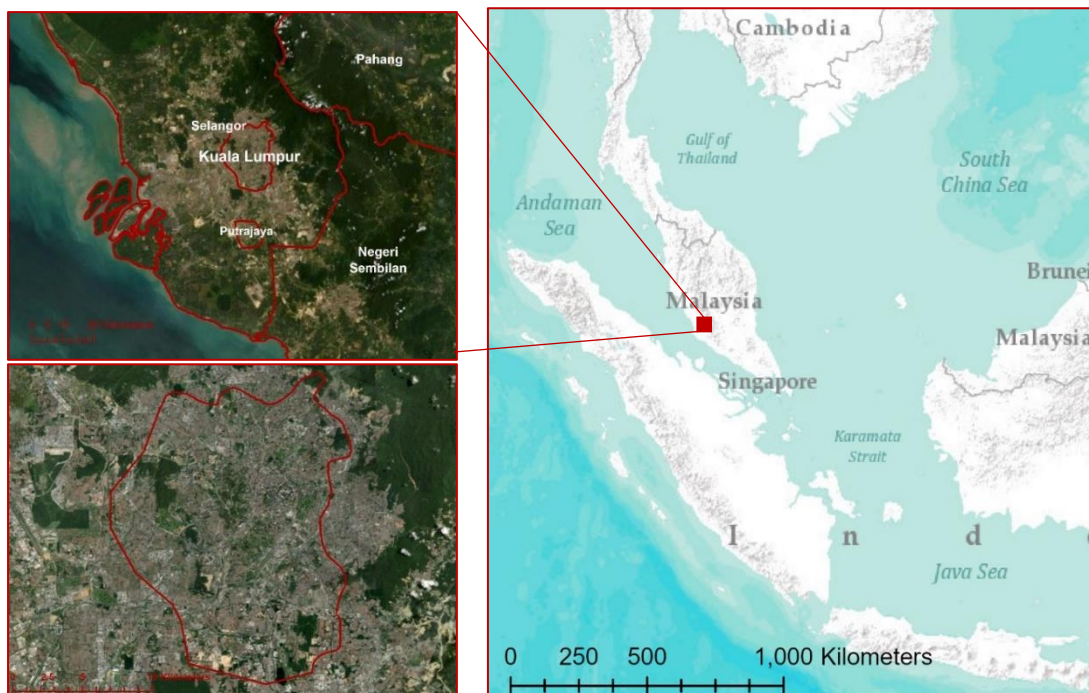

Figure 10. Kuala Lumpur City, satellite overview.

3.2 Environment

Location: Central West Coast, Peninsular Malaysia

Area: 243km^2

Climate System: Tropical rainforest.

Average Yearly Precipitation: 2486mm (129mm to 286mm).

Natural Resources

Water

Kuala Lumpur is situated in the Klang Valley Basin. The Klang drains 1,342km^2 and extends 120km through the most urbanised region of Malaysia. Originating in the mountainous Selangor state districts of Gombak and Hulu Langet, the Klang is fed by 10 major tributaries and influences by two large upstream supply dams: Batu Dam and Klang Gates Dam.

Ongoing management challenges include: soil erosion and sedimentation, flooding (averaging 3 major floods per year) and solid waste pollution[38]. Recurring regional water shortages are also a major concern. These result from dry upstream conditions coupled with a high local reliance on river reservoirs for potable water. This led to water rationing in Kuala Lumpur and Selangor in 2014 and 2015[39].
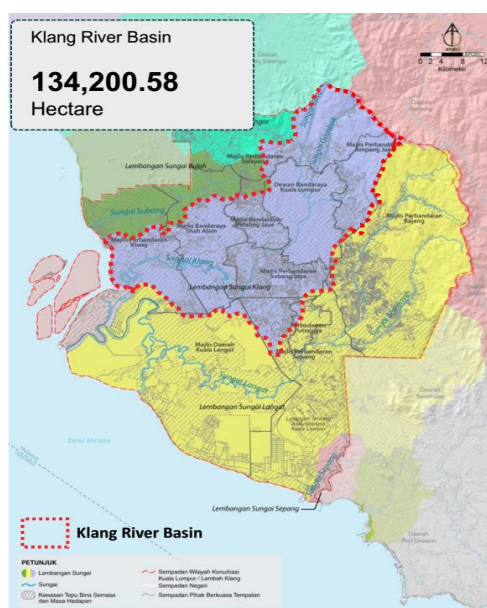

Figure 11. Klang River Basin. Source: Urbanice, 2020

Figure 12. Klang River in Kuala Lumpur. Source: DBKL, 2004

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[38] ADB, 2007. Klang River Basin Environmental Improvement and Flood Mitigation Project. https://www.adb.org/projects/ln1500/main
[39] Academy of Sciences Malaysia, 2017. Strategic Plan for Integrated River Basin Management (IRBM) in Malaysia. https://www.akademisains.gov.my/irbm-volume-1/

Initiatives such as the: River of Life, Selangor Maritime Gateway, One State-One River and the ADB Basin Environmental Improvement and Flood Mitigation Project, focus on addressing these challenges. So far, the Integrated Flood Forecasting and River Monitoring Project in the Klang Valley has greatly increased monitoring capacity and established 88 hydrological stations[40].

Forests

Long term urbanisation trends and palm oil expansion have resulted in widespread deforestation across Peninsular Malaysia. Between 2001 and 2019 Malaysia had one of the world's highest rates of forest loss for its size, losing 28% of national tree cover[41]. However, in recent years Kuala Lumpur has worked to preserve green space and nature in the city. At present, green cover accounts for 30% of total land area[42] and has several protected nature reserves including the KL Forest Eco Park, Bukit Sungai Besi Reserve and Bukit Sungai Putih Reserve.

Minerals

While Kuala Lumpur was first founded in support of the local tin industry, today primary sector production make only a small contribution to the city economy. In the surrounding Selangor Province aggregate, coal and tin mining is more prevalent.

Climate Change

Key climate risks to Kuala Lumpur include: increasing urban flood frequency and intensity, and increasing extreme weather events. Additionally rising temperatures will create greater energy demand to cool urban infrastructure. Malaysia's guiding framework, actions and objectives on climate change are laid out in the 2009 National Policy on Climate change.

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[40] Department of Irrigation and Drainage, 2018. Water Resources Study. https://www.water.gov.my/index.php/pages/view/665?mid=295
[41] Global Forest Watch, 2019. Malaysia: Forest Change https://www.globalforestwatch.org/dashboards/country/MYS
[42] Kanniah, Kasturi. (2017). Quantifying Green Cover Change for Sustainable Urban Planning: A case of Kuala Lumpur, Malaysia. Urban Forestry & Urban Greening. 27. 10.1016/j.ufug.2017.08.016.

3.3 Services

Waste Management

National waste solid waste production has rapidly expanded over the last decade. 2020 generation is estimated at 45,900 tonnes/day. Malaysia is also major importer of plastic waste, taking in 870,000 tonnes in 2018. Informal actors are an established section of the SWM value chain in Malaysia, ranging from independent waste pickers and scrap collectors to larger recycling plants. This means a significant proportion of the recycling sector is unregulated and therefore accurate data is difficult to obtain. Due to growing awareness of the scale of the waste challenge facing Malaysia, national policy has significantly shifted in recent years. More stringent import conditions and a crackdown on the illegal waste sector meant that by 2019 imports were reduced to only 143,000 tonnes and over 100 illegal plants were shut down[43]. Recent estimates suggest national recycling rates are around 24.6% and 11.4% for plastics (2017)[44]. However, though domestic waste segregation has been legally required since 2015 engagement, public awareness is still low[45].

Waste collection in Kuala Lumpur is overseen by the Department of National Solid Waste Management and the Solid Waste Management and Public Cleansing Corporation (SWCorp). At a local-level city operations are managed by the private Alam Flora Company which complete twice weekly collections. High urban density and growing consumption have produced per capita waste
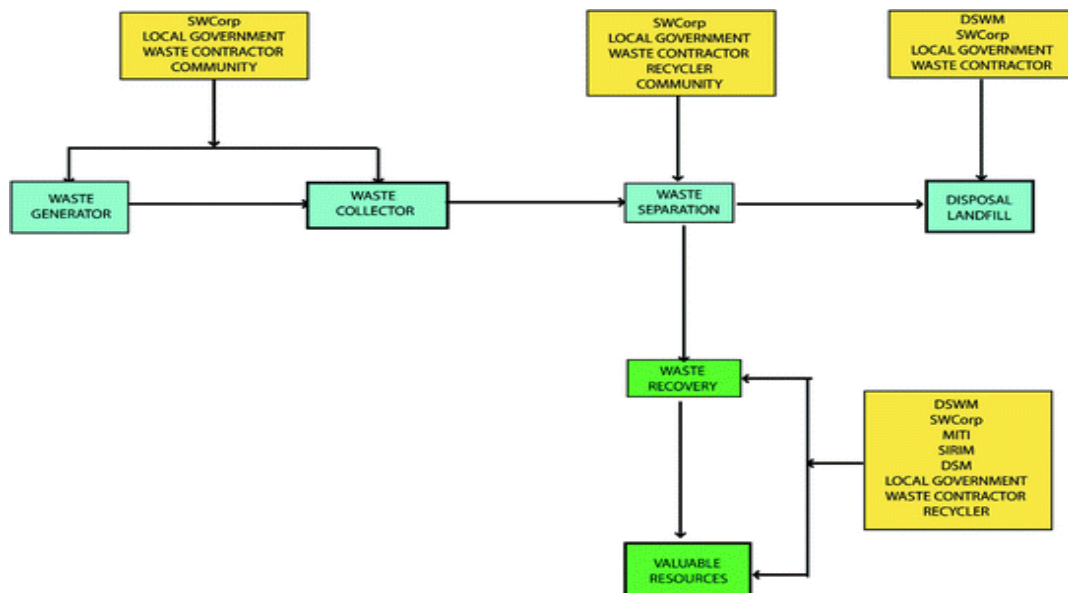

Figure 13. Stakeholders and waste flow in Malaysia. Source: Mohamed et al., 2018

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[43] MESTECC, 2019 Importation of Plastic Waste to Malaysia, https://www.impel.eu/wp-content/uploads/2019/10/3-Importation-of-plastic-waste-to-Malaysia.pdf
[44] Khazanah Research Institute, 2019. Plastic: An Undegradable Problem.
http://www.krinstitute.org/assets/contentMS/img/template/editor/Views_Plastic%20An%20Undegradable%20Problem.pdf
[45] Cheng & Osman, 2017. Waste Segregation Behaviour at Source: Attitude, perceived behavioural control, subjective norm, and environmental education. 29. 1-18.

rates of around 1.62kg per person per day, almost double the national average. This is expected to continue to increase, reaching 2.23kg/capita by 2024[46].

About 95% of collected waste in Kuala Lumpur is sent to the Taman Beringin Transfer Station[47]. This redistributes waste from Kuala Lumpur to sanitary landfills and disposal sites outside the city. The largest of these is Bukit Tagar in Hulu Selangor. This 700ha landfill is situated about 50km to the north and aims to operate until 2045. Because the central transfer station has only 1700ton/day capacity operations here are already under significant pressure. To mitigate this load a 1,200 ton/day waste-to-energy plant near the site has been proposed[48].

Key challenges to plastic management include: limited public awareness, low recycling rates, high costs for alternative products, poor local enforcement, and a lack of integrated waste management approaches.

Total solid waste generation: 3739 tons/day[49]

% Plastic Waste: 24%[50]

Total Plastic waste generation: 897 tons/day (calculated)

Figure 14. Klang Valley Waste Disposal Sites. Source: Urbanice, 2020

[46] Saeed et al., 2009. Assessment of municipal solid waste generation and recyclable materials potential in Kuala Lumpur, Malaysia. *Waste Manag.* 29(7):2209-2213. doi:10.1016/j.wasman.2009.02.017
[47] Osmi et al, 2013 Enhanced the Municipal Solid Waste Management in Kuala Lumpur by Implementing Technologies from European Countries: Strategies and Action Plans. International Journal of Civil Engineering and Geo-Environmental, 4. pp. 23-34. ISSN 2180-2742
[48] Taib M., Ho W., Ng P., 2017, Development of Waste-to-Energy Plant in Kuala Lumpur, Chemical Engineering Transactions, 56, 1237-1242.
[49] Estimate by: Aja & Al-Kayiem, 2014. Review of Municipal Solid Waste Management Options in Malaysia with an Emphasis on Sustainable Waste-to-Energy Options. *J Mater Cycles Waste Manag* 16:693-710 DOI 10.1007/s10163-013-0220-z
[50] Ibid: Aja & Al-Kayiem, 2014.

Digital Readiness

Promoting ICT uptake and high-tech business is an important policy goal in Malaysia. As the centre for the country's digital economy, Kuala Lumpur has developed strong technology infrastructure and high human resource capacity. Over time the government has provided significant incentives for digital development from the formation of the Multimedia Super Corridor (MSC) in 1996 to the Digital Free Trade Zone established in 2017. Kuala Lumpur City Hall aims to be a fully electronic, paperless governing body in line with the Public Sector ICT Strategic Plan 2016-2022.

National Index Score[51]**:** 14.31/25

Global Digital Readiness Rank: 38

Global Networked Readiness Rank[52]**:** 32

Water Provision

Kuala Lumpur has a comprehensive and good quality water supply. Urban coverage is >99% and provided by the state-owned Air Selangor utility company. This is primarily sourced and treated from 6 large supply reservoirs located in Selangor State. despite strong infrastructure changing climate conditions and increasing drought likelihoods pose a risk to municipal water security.

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[51] Ibid: Cisco, 2019.
[52] Ibid: Portulans Institute & WITSA, 2019.

3.4 Society

Malaysia is a highly urbanised country (76%[53]) and has a total population of 32.7m[54]. As the capital city, Kuala Lumpur provides social and economic opportunities for around 1.8m people across 461,600 households[55]. Following national trends, Kuala Lumpur's population has begun to plateau, with growth rates slowing from +2.4% in 2015 to -0.2% in 2018[56]. Despite slowing population growth, long-term urbanisation patterns are expected to continue and reach 90% urban residency by 2050. Additionally, growth is still expected in the wider conurbation which is seeing faster annual changes (4-6%) than the city proper. This has led to expansive unplanned sprawl through the surrounding Selangor State and generated significant mobility and infrastructure challenges. Urban planning priorities in Kuala Lumpur include developing public transit infrastructure, the provision of affordable housing, and strengthening pollution and waste management.

Kuala Lumpur's economy is a strong draw for internal and external migrants. As such, the city has developed a diverse multi-lingual and multi-ethnic culture. Malay, Chinese and Indian groups make up the urban majority with additional representation from Kadazans, Iban and other indigenous groups. Despite transformative social and economic change over the last few decades Kuala Lumpur remains a melting pot for the old and new of Malaysia. This creates a unique urban identity allowing the ancient Batu Caves to coexist with towering skyscrapers such as the Petronas Twin Towers.

City Population: 1.824m[57] (KL Federal Territory); 7.78m (Greater Kuala Lumpur).

Population density: 7506 people/km^2 (calculated)

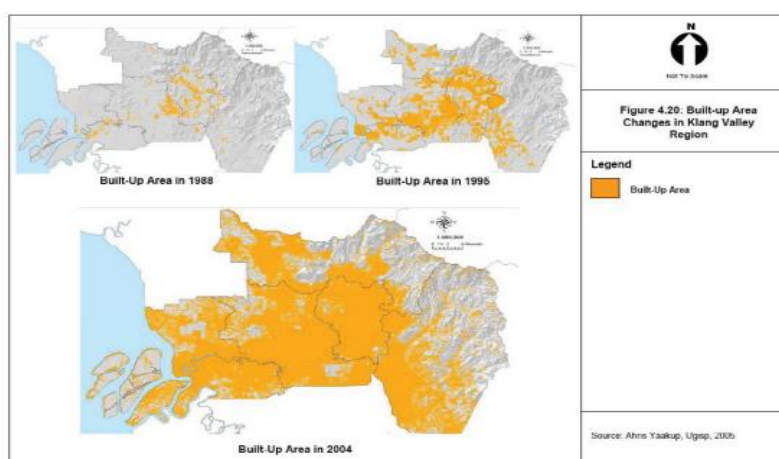**Kuala Lumpur Human Development Index:** 0.86[58] (0.804 national)

Figure 15. Klang Valley urbanisation 1998-2004. Source Ahris Yaakob, 2005.

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[53] Ibid: UN, 2018
[54] Department of Statistics Malaysia, 2020. Demographic Statistics First Quarter 2020. https://www.dosm.gov.my
[55] Khazanah Research Institute, 2019. State of Households: Different Realities Report http://www.krinstitute.org/assets/content/MS_KRI_SOH_2018.pdf
[56] Department of Statistics Malaysia, 2018. Kuala Lumpur @ a Glance https://www.dosm.gov.my
[57] Ibid: UN Data, 2019
[58] Global Data Lab, 2020. Subnational Human Development Index: Malaysia https://globaldatalab/shdi

3.5 Economy

National

Malaysia is the third largest economy in ASEAN and has experienced average annual growth of 5.4% since 2010[59]. It is classified as an upper middle-income economy and has large a manufacturing sector, particularly for electronics, as well as tourism, finance and oil and gas. It is also the second largest producer of palm oil in ASEAN, producing 98.4m tonnes in 2019. By 2030 Malaysia aims to restructure its low-skill, labour-intensive economy into a knowledge-based economy. Improving human capital, through social policy, improving education and technological capacity, and tackling income inequality are high priorities[60].

Due to a heavy dependence on exports Malaysia is particularly vulnerable to the economic shocks of COVID-19. This has been compounded by a global drop in oil prices. In the first quarter of 2020 economic growth had slowed to 0.7% down from 4.5% over the same period in 2019. The relative wealth of Malaysia has allowed for creation of large stimulus packages and therefore economic growth is expected to rebound strongly to 9% in 2021[61]. Foreign direct investment declined in 2018 driven by reduced quarrying and mining activity, however overall investment remains high, averaging $36.4bn 2010 – 2019. The World Bank ranked Malaysia as 12th in its annual ease of doing business report in 2019.
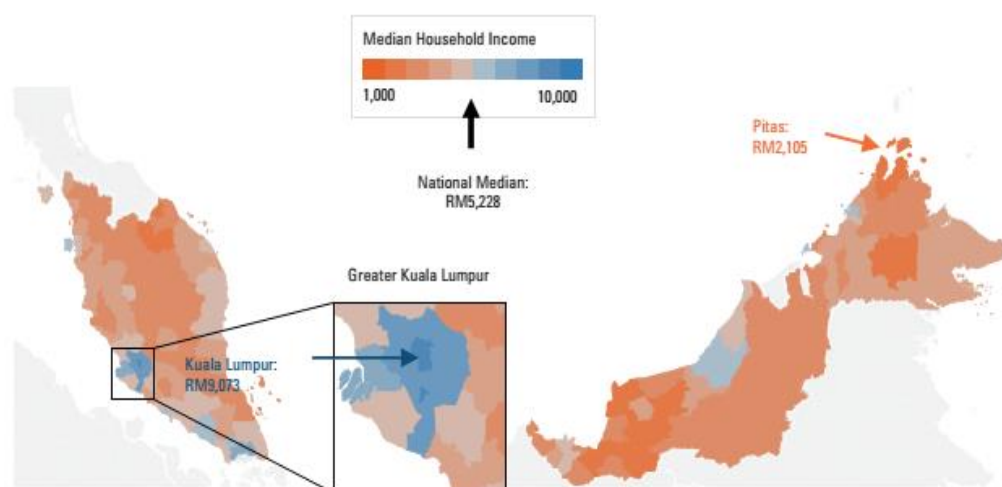
GDP: $358.582bn[62]

GDP per capita: $11,373

Figure 16. 2016 Median household income. Source: Khazanah Research Institute, 2018

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[59] Ibid: World Bank, 2020.
[60] Prime Minister's Office, 2019. Shared prosperity Vision 2030 https://www.pmo.gov.my/2019/10/shared-prosperity-vision-2030-2/
[61] Ibid: IMF, 2020.
[62] Ibid: World Bank, 2020.

Economy by Sector[63]**:**   Agriculture - 7.1%   Industry/Construction – 34.1%

(2019)   Services – 57.7%

City

Kuala Lumpur is the wealthiest state in Malaysia and accounts for 16% of GDP. Economic growth averages 6-7% per year and per capita GDP is more than double the national average. In 2018 the largest growth rates were found in the construction (6.8%) and service (7.3%) sectors[64]. The city is a regional financial centre and specialises in Islamic finance. This totalled $224bn in banking assets in 2018, the largest in the world. The wider Klang Valley is heavily reliant on Kuala Lumpur's economic output. Kuala Lumpur is also a major tourist destination and ranked in the top 10 most visited cities in the world[65]. Additionally the integration of the Greater Kuala Lumpur region with China's maritime Belt and Road Initiative suggests sustained investment in infrastructure and connectivity in future.

GDP: $50bn
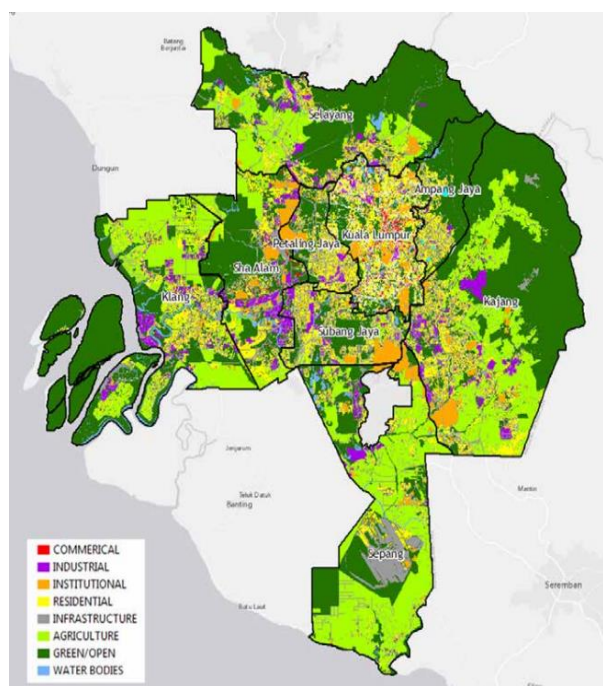
GDP per capita: $27,845 (2018)[66]

Figure 17. Land use in Greater Kuala Lumpur 2010. Source: World Bank, 2015
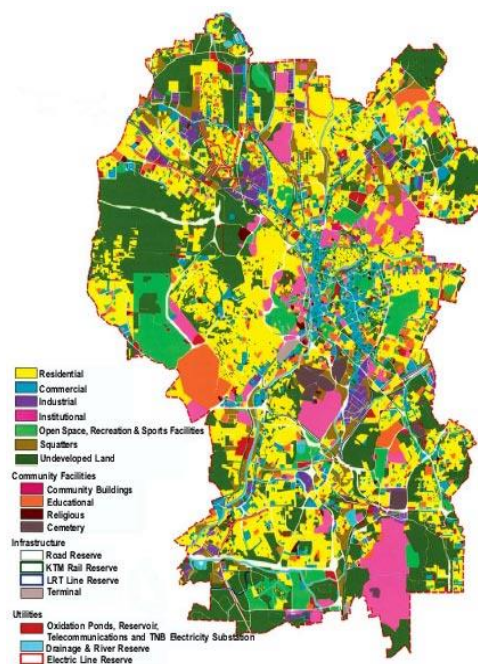

Figure 18. Land use in Kuala Lumpur Federal Territory. Source: KLCH, 2004.

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[63] Department of Statistics Malaysia, 2020. National Accounts: Economic Performance 2019
[64] Department of Statistics Malaysia, 2018. State Socioeconomic Report 2018.
[65] Euromonitor International, 2019 Top 100 City Destinations Report https://go.euromonitor.com/white-paper-travel-2019-100-cities.html
[66] Ibid: Department of Statistics Malaysia, 2018.

3.6 Governance

National

Malaysia is structured into 11 states and 2 federal territories. The urban centre of Kuala Lumpur is classed as a federal territory and managed under the jurisdiction of the Federal Territories Ministry of Malaysia. Malaysia is governed as a representative democracy with state governments established under their respective state constitutions. Policy is developed and implemented through a three-tier structure of federal, state and local authorities.

City

Kuala Lumpur Federal Territory is directly administered by Kuala Lumpur City Hall. This is composed of 24 departments and plays a central role in decision-making and development planning. Departments are organised along four main themes: planning, management, socio-economic development and project management. Kuala Lumpur City Hall is responsible for implementing physical and socioeconomic development programmes, city planning and management and the provision of basic urban services. This is framed through the Kuala Lumpur Strategic Plan 2020 which

Figure 19. Kuala Lumpur City Districts.

Figure 20. Local authorities of the Klang River Basin.
Source: Urbanice, 2020

outlines finance, industry, tourism and trade objectives. At a local level Kuala Lumpur is managed as 11 districts under the central authority of the City Hall.

Transboundary Considerations

Urban planning interventions will be complicated by the transboundary nature of both the Klang River and the Greater Kuala Lumpur urban conurbation. Upstream water degradation and solid waste leakage pose risks to both Kuala Lumpur city and other downstream settlements including Shah Alam, Klang City and Port Klang. Additionally, the Greater Kuala Lumpur urban area intersects with 3 districts and 11 mukims (municipalities) in the State of Selangor. Coordination with Gombak District will be particularly important.

Due to its length the Klang River is similarly transboundary. It intersects seven local authorities and as such any actions to address solid waste must consider up and downstream stakeholders. Particularly important are the differing development trajectories and objectives observed between Kuala Lumpur and the encircling State of Selangor. Effective communication and coordination of institutional partners will be required to mitigate any disconnect between pollution stakeholders along any plastic leakage pathways.

Since 2003 under the designated River Basin Management Units have been required to produce multiyear basin master plans[67].

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[67] Ibid: Academy of Sciences, Malaysia, 2017.

3.7 Key Plans, Policy and Regulations

Urban Development

Eleventh Malaysia Plan 2016-2020.

Defines national targets up to 2020. Aims to improve productivity, innovation and quality of life in Malaysia. Its successor the 2021-2025 plan is currently undergoing review in wake of Covid-19.

Kuala Lumpur Structure Plan 2020.

Approved in 2004, this presents Kuala Lumpur's urban development objectives by 2020. This aimed to: enhance international commerce and finance, develop an efficient and equitable urban structure, improve the living environment, establish a unique urban identify, and implement effective city governance.

Kuala Lumpur City Plan 2040.

An updated plan for the 2020-2040 period currently in the draft stage. This plan presents development targets across six themes: economic sustainability, inclusive community, city greening beautification, low carbon city, efficient mobility, and integrated land management.

Kuala Lumpur Drainage Masterplan.

Addresses river engineering, flood risk and pollution management for Kuala Lumpur's waterways. Includes provision of 1,000 gross pollutant traps, 74km of new drainage, 11 pumping stations, 71 storage ponds and a 3.9km flood wall.

Strategic Plan for Solid Waste Management (NSP) 2005.

Adopted in 2005 and provides the foundation for further solid waste legislation. Aims for 22% waste reduction and recovery, and 100% urban waste segregation by 2020.

Master Plan on National Waste Minimization 2006.

Provides policy suggestions, federal and local action plans and establishes guidelines for waste minimisation.

National Solid Waste Management Policy 2006.

Developed to facilitate the development of an integrated solid waste management (ISWM) system in Malaysia.

Solid Waste and Public Cleansing Management Act 2007.

Mandates solid waste regulations and management practices. Adopted alongside the *Solid Waste and Public Cleansing Management Corporation Act* which mandated the establishment of a national Solid Waste Corporation (SWCorp).

Solid Waste Corporation Strategic Plan. 2014-2020.

Outlines SWCorp's policies and action plans adopted in accordance to their legal obligations. Has provisions for environmental, financial and management targets and expansion.

Environment

Environmental Quality Act 1974.

This act makes provision for the prevention, abatement and control of pollution for the enhancement of the environment in Malaysia.

National Policy on the Environment 2002.

Presents national objectives, principles and 'green strategies' to guide environmental and natural resource management. Created the framework for environmental policy development and priorities to 2020.

Malaysia Roadmap Towards Zero Single Use Plastics 2018-2030

A three-phased national plan to eliminate single-use plastics. Currently in Phase 1 aiming to develop a legal and governance framework, implement a pollution charge, establish communication, education and public awareness programs and improve stakeholder capacity. A supporting Circular Economy Roadmap (CER) is set to be introduced by the Ministry of Water and Environment in 2020.

Malaysia National Cleanliness Policy 2019

Beginning in 2020 this plan defines 14 strategies and 91 action plans to address national cleanliness and waste to 2030. Actions are definied across 5 policy clusters: awareness of cleanliness, environmental sustainability, circular economy, governance and enforcement, human capital development.

Sustainable Development Goals

Though Malaysia lacks a dedicated SDG action plan, the principles and targets of the Eleventh Malaysia Plan and the 2010 New Economic Model. Progress towards the SDGs is assessed under the National SDG Council and the SDG Steering Committee, headed by the Economic Planning Unit. Individual development goals are then allocated between 5 working committees under the themes of:

Inclusivity, Well-being, Human Capital, Environment and Natural Resources, and Economic Growth. These committees are composed of members from the public, private, NGO, CSO and academic sectors.

SDG 11.6: Reduce the Adverse environmental impacts on people in urban areas, including by strengthening management of air quality, urban waste and other sources of waste.

Lead agency: Working Committee for Well-being.

SDG12.5: By 2030, substantiallly reduce waste generation and increase the economic value of water resources through prevention, reduction, recycling, reuse, and recover of energies from waste treatment.

Lead agency: Working Committee for Environment and Natural Resources.

SDG14.1: By 2030, prevent, significantly reduce and successfully control marine pollution of various forms, particularly pollution from land-based activities, including solid waste, waste water and organic substances pollution.

Lead agency: Working Committee for Environment and Natural Resources.

Figure 21. Agenda 2030 and the 11th Malaysia Plan. Source: EPU, 2019

3.8 Key Stakeholders

Governing Institutions

Kuala Lumpur City Hall

> *Department of Health and Environment*
>
> *Department of Public and Drainage Engineering.*
>
> *Department of Landscaping and Recreation Development*
>
> *Department of City Planning*
>
> *Department of Infrastructure Planning*

Ministry of Science, Technology and Innovation

> *Malaysia Green Technology and Climate Change Centre*

Ministry of Environment and Water.

> *Department of Environment*
>
> *Department of Irrigation and Drainage*

Ministry of Housing and Local Government

National Water Resources Council

International Projects and Donors

WWF - Extended Producer Responsibility Project (*regional*)

Private Sector

Malaysia Plastics Pact

4. Surabaya, Indonesia

4.1 Overview

Surabaya is the second largest city in Indonesia. It is the provincial capital of East Java and a regional centre for development, trade and culture. Surabaya municipality has a population of 3.15m with over 10m living in the wider metropolitan area of Gerbangkertosusila. Economic output stands at $38.4bn, growing annually at a rate of around 6%. This is driven by a majority service economy with productive retail, manufacturing and accommodation and food service sectors. The historic port of Surabaya remains a strategic asset and is the 2nd busiest in Indonesia.

Surabaya is situated in the expansive Brantas River Basin which drains over 11,800km^2. The Kali Mas River branches from the Brantas and flows through Surabaya City to discharge into the Madura Strait. Flooding, climate change and tacking water pollution remain key environmental challenges for Surabaya.

The City Government of Surabaya is responsible for urban administration and management. Development and waste management initiatives are then implemented through a structure of community and neighbourhood associations. Surabaya is unique in its strong system of community waste management, with individual districts and neighbourhoods collecting, segregating and processing household waste. Ambitious city development plans and a strong focus on sustainability has led to international recognition and high environmental standards compared to many ASEAN cities. Government incentives and investment has allowed the establishment of over 200 community-scale waste disposal and 21 composting sites. Closing the Loop will hope to engage this network alongside local government agencies to improve plastic waste tracking and management in Surabaya.
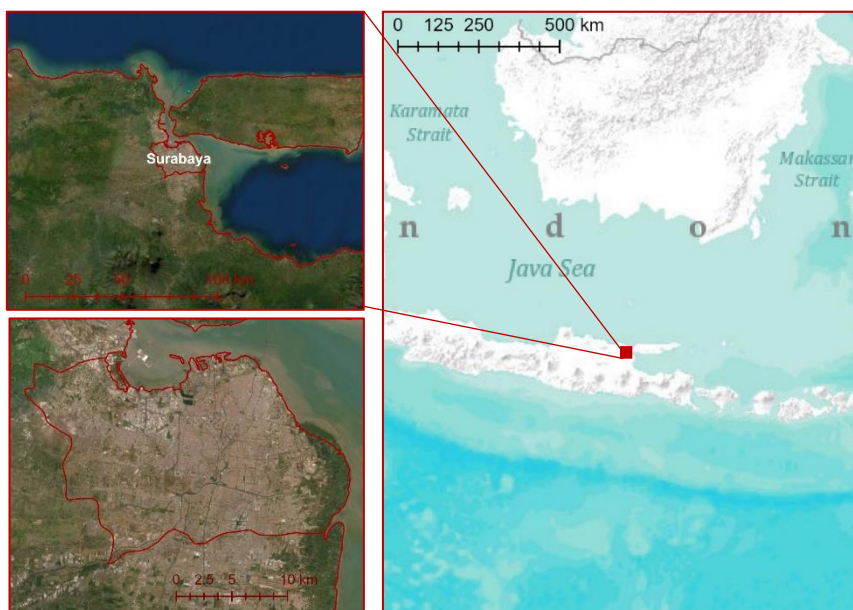

Figure 22. Surabaya Satellite Overview.

4.2 Environment

Location: East Java Province

Area: 326km^2

Climate System: Tropical Savannah

Average Yearly Precipitation: 1679mm (13mm to 317mm)

Natural Resources

Water

Surabaya City is situated on the Kali Mas River in the north of the Brantas River Basin. The Brantas drains 11,800km^2, approximately 25% of Java's land area, and stretches 320km from the southern volcanic highlands to ultimately discharge into the Madura Strait[68]. The Surabaya sub-basin is much smaller, around 650km^2, and also includes areas of the surrounding Gresik and Sidoarjo Regencies. The Kali Mas plays a key role in city drainage and during the wet season can experience high flows and flooding. This is a particular concern for informal riparian communities.

As a coastal city, Surabaya sits along the narrow Madura Strait, a shallow and very busy sea channel that seperates the Madura and Java Islands. Much of Surabaya is low elevation, typically 3-6m above sea level, which has allowed for the formation of estuarine mangrove and wetland ecosystems. There is also substantial surface water reserves, present as a network of smaller streams, lakes and fishponds across the city.
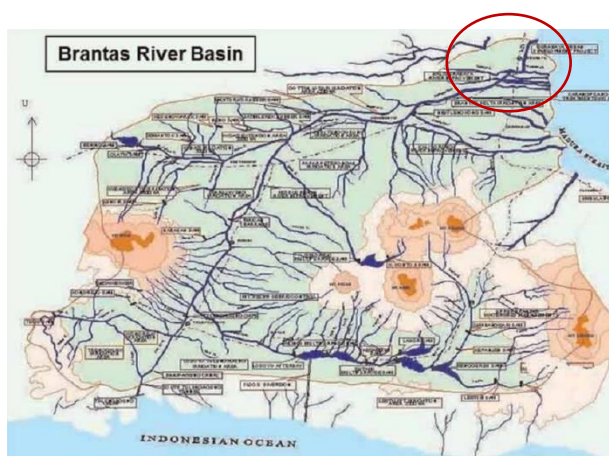

Figure 23. Brantas River Basin. Source: INBO, 2000

Figure 24. Surabaya Drainage Zones. Source: Surabaya City Government 2018-2038

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[68] Subijanto, at al., 2013. Key success factors for capacity development in the Brantas River Basin organisations in Indonesia. Water Policy. 15. 183. 10.2166/wp.2013.019.

Present water management challenges include, river and coastal pollution (primarily from untreated effluent discharge and solid waste), seasonal water scarcity, and urban flooding. There are several urban planning initiatives ongoing to help mitigate these vulnerabilities.

Existing water infrastructure includes heavy damning throughout the Brantas Basin. These are mainly located upstream, however the Gunungsari and Jagir Dams can be found in south Surabaya.

Forests

Despite high national deforestation rates Surabaya has retained 21.8% greenspace with a target of 30%[69]. Following the 2007 Law on Spatial Planning there have been increasing efforts to expand park coverage and integrate nature into Surabaya City, for example through the Green and Clean Initiative.

Minerals

Despite having few mineral resources itself, Surabaya remains a key sea terminal for Javanese mining and trade.

Climate Change

Emerging climate risks include sea level rise, salt water intrusion and urban flooding. Longer term climate trends include a delayed and shorter duration for rainy season across Java, predicted to reduce annual precipitation up to 15% by 2100[70].
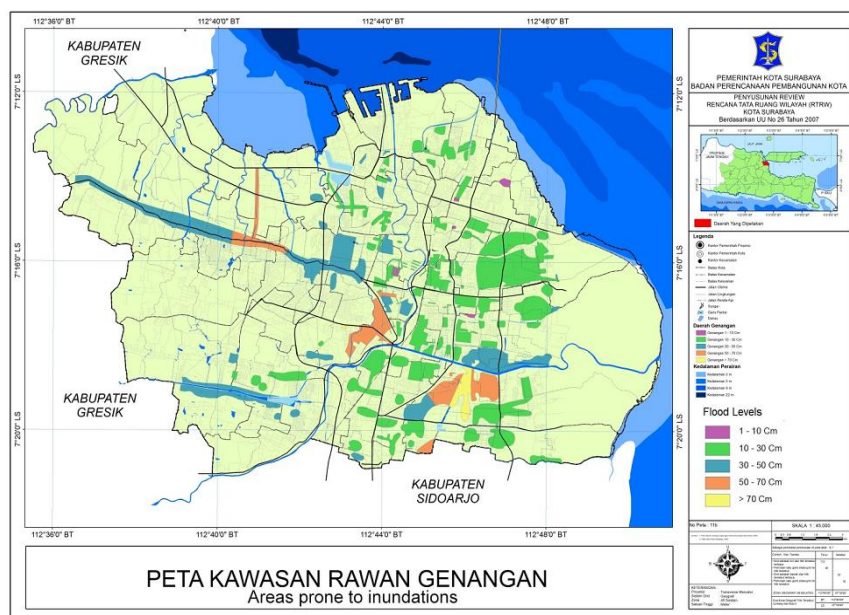

Figure 25. Surabaya flood extent map. Source: Surabaya City Planning Board, 2009

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[69] City Government of Surabaya, 2019. Lowering the Temperature to 2 Degrees, here's how Mayor Risma fights Pollution in Surabaya. https://surabaya.go.id/id/berita/51526/turunkan-suhu-hingga-2-derajat

[70] Case at al., 2007. Climate Change in Indonesia Implications for Humans and Nature. http://awsassets.panda.org/downloads/inodesian _climate_ change_impacts_report_14nov07.pdf

4.3 Services

Waste Management

Indonesia faces significant national challenges in scaling-up solid waste collection and management. At present, 70% of urban residents have access to waste collection, of which only 55% is handled at a formal transfer station or processing facility[71]. Similarly the diverse geographies, development challenges and decentralised governments of Indonesia have resulted in high variability of capacity and performance between cities.

Surabaya City exhibits strong waste management practices and presents a good benchmark for neighbouring settlements. Over the course of several regional and city initiatives, solid waste generation has been actively reduced from a 2000 tonnes per day peak in 2001 down to 1512 by 2017[72]. Most impactful include the Adipura, Green and Clean, Waste Bank, and Promotion and Implementation of the 3Rs programmes which helped facilitate the development of community-led waste management. Particularly, Surabaya's experience with organic waste composting, community waste segregation and intracity benchmarking provide effective case studies for behavioural change and local-scale waste management.

Extensive city investment in waste infrastructure further helped increase coverage and efficiency. Surabaya now has 21 composting centres, over 200 temporary disposal sites (waste banks), 1 medium sorting station (Super Depo Sutorejo) and 1 sanitary landfill (Benewo). The community-run waste banks are particularly effective and pay for segregated recyclables, providing opportunity for greater engagement with the informal sector. Neighbourhood benchmarking also plays a key role, with the best performing communities (such as Jambangan VII and Gunung Sari) winning prizes including cash payments, tools and trees for neighbourhood greening. These initiatives were each supported by a widespread communications and outreach campaign helping to mainstream sustainable waste management in Surabaya. In 2019 overall waste handling was estimated at 95%[73]

Several organisations are also utilising some more innovative waste management solutions. For example, the Jambangan Recycling centre now breeds black soldier fly larvae to compost organic waste, while the city bus network allows fare payments with plastic bottles, resulting in approximately 16,000 plastic passengers per week.

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[71] World Bank, 2017. City Technical Capacity Report for Solid Waste Management Investment Preparation for Indonesia. http://documents.worldbank.org/curated/en/194401508742537177/pdf/SFG3675-V1-REVISED-EA-P157245-PUBLIC-Disclosed-1-26-2018.pdf
[72] UNEP and IGES, 2017. Planning and Implementation of ISWM Stagies at Local Level: The Case of Surabaya City. http://hdl.handle.net/20.500.11822/30987
[73] World Bank, 2019. Improvement of Solid Waste Management to Support Regional and Metropolitan Cities, Indonesia. https://projects.worldbank.org/en/projects-operations/project-detail/P157245

Ongoing areas for improvement include further expansion of the sustainable management system through awareness raising, capacity building, financial support and establishing policy frameworks[74].

Total solid waste generation: 1512 tonnes

% Plastic Waste: 16%

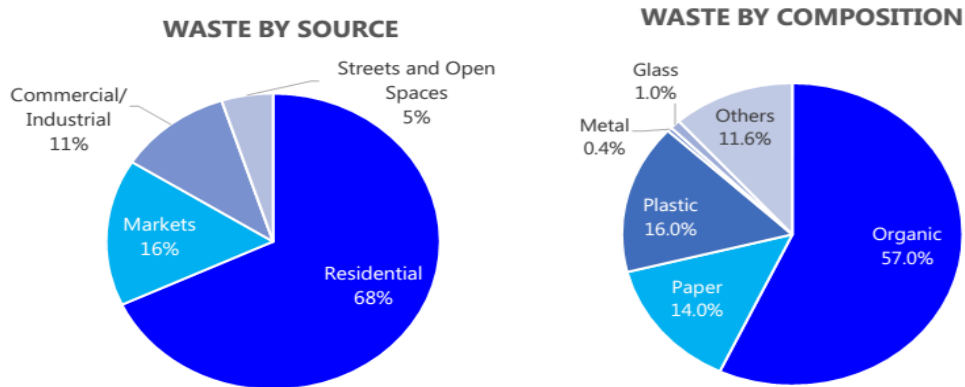**Total Plastic waste generation:** 242 tonnes/day

Figure 26. Surabaya waste characteristics. Source: Surabaya City, 2016 via UNEP, 2017.
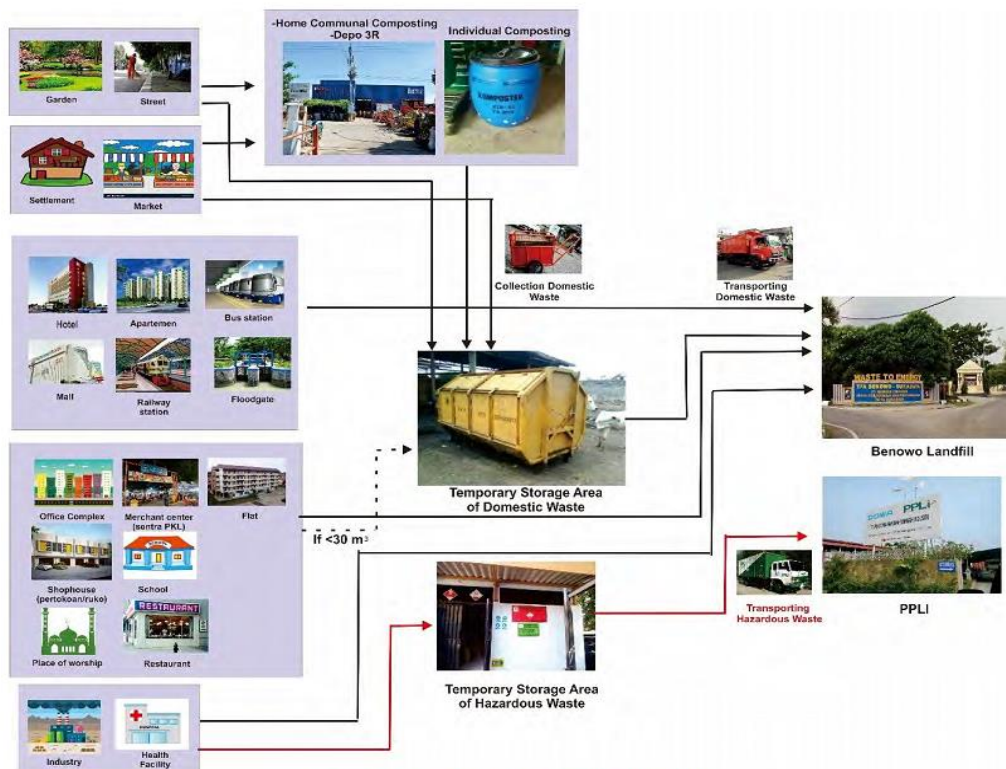

Figure 27. Waste management pathways Surabaya. Source: UNEP, 2017

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[74] IGES, 2017 Development of Work Plan for Reducing SLCPs from MSWM in Surabaya, Indonesia. http://www.waste.ccacoalition.org/ sites/default/files/files/surabaya_city_work_plan.final_.2017.01.20.pdf

Digital Readiness[75]

Since 2002 Surabaya has been pioneering an 'e-governance' system for city administration. This has developed into a wide portfolio of applications including e-Monitoring, e-Education, e-Health, and e-Procurement[76]. In particular the e-Musrenbang app presents a streamlined regional development planning system and increases transparency through accessible online data. The 'Surabaya Single Window' provides a similar solution, allowing parallel online applications for city licencing services. The uptake of ICT coupled with widespread smartphone usage has also allowed for new mediums of democratic engagement and facilitates direct feedback from citizens to improve public trust and communications.

National Index score: 11.68/25

Global Digital Readiness Rank: 73

Global Networked Readiness Rank[77]: 76

Water Provision

Municipal water in Surabaya is provided by the state-owned PDAM Surya Sembada Kota Surabaya and reached 98% service coverage in 2019[78]. As 97% of this water is sourced from surface water sources (Surabaya, Kali Mas, Umbulan Spring, Pandaan Spring) reducing river pollution is very important. With the city experiencing a supply-demand deficit of around 5.5million m^3/yr[79], improving water allocation and service efficiency will be key to secure future water security. The East Java Water Resource Services Agency is responsible for distributing water use licences among public and private entities across the city.

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[75] Ibid: Cisco, 2019.

[76] Surabaya Public Relations Section, 2018. 'Pioneering e-Government, Surabaya City Government Creates Hundreds of Applications' https://humas.surabaya.go.id/2018/04/05/pelopori-e-government-pemkot-surabaya-sudah-ciptakan-ratusan-aplikasi/

[77] Ibid: Portulans Institute & WITSA, 2019.

[78] Harsono, 2019. '98 Percent of Surabaya People can Access Clean Water' https://www.liputan6.com/health/read/3923421/98-persen-masyarakat-surabaya-sudah-bisa-akses-air-bersih

[79] IHE Delft, 2019. 'Altwater – Water supply and demand in Surabaya, Indonesia: Current Situation and Future Scenarios. https://www.un-ihe.org/water-supply-and-demand-surabaya-indonesia-current-situation-and-future-scenarios

4.4 Society

Indonesia is a highly diverse nation composed of over 17,000 islands and home to 268 million people. It is urbanising at a rate of 4.1% per year and expected to reach 68% urban cover by 2025. Much of this urbanisation is occurring on the island of Java in western Indonesia. This is the most populous island and predicted to reach 152m in 2020[80]. Major settlements include the national capital of Jakarta in the north-west, Semarang in central java, Bandung in the west and Surabaya in the east. Population growth rates have been slowing in Java over the last decade settling around 1.1% per year. Rapid development has slashed poverty rates by more than half since 1999 down to 9.4%. Provincial poverty in East Java has followed this trend, declined over time from 6.25% in 2012 to 4.88% in 2018[81].

Surabaya is the second largest city in Indonesia and one of the oldest, founded in the 10th century. The city has a population of 3.15m and is growing at around 2% per year (2018). The city district is fully urbanised and wider metropolitan area has an estimated population of over 10 million. Urban land cover in Surabaya district increased by 1555ha between 2013 and 2018[82], primarily the result of agricultural land conversion in east subdistricts. Population density varies greatly, from 2,655
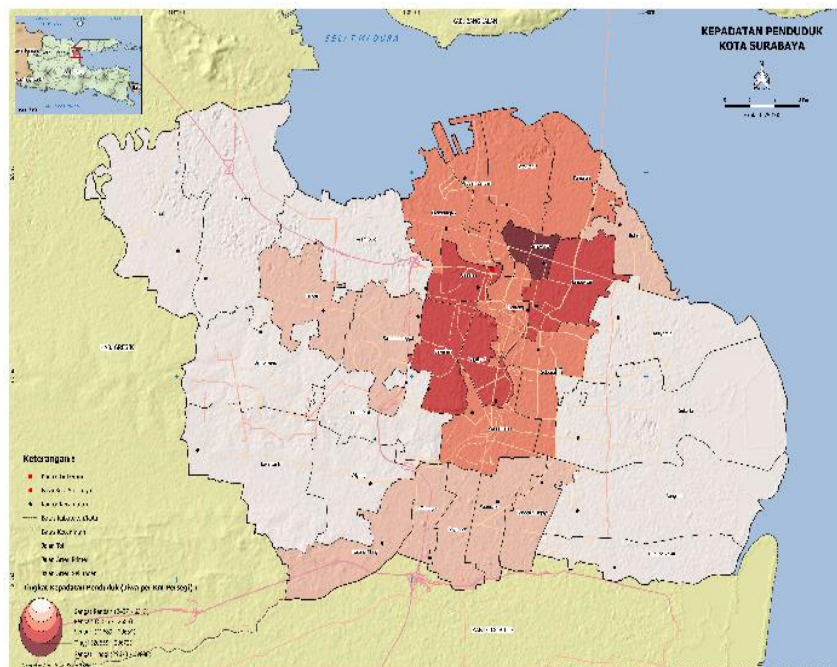

Figure 28. Surabaya sub district population density. Source: Open Street Map, 2017

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[80] Statistics Indonesia (BPS), 2018. Population Projection by Province 2010-2035.
https://www.bps.go.id/statictable/2014/02/18/1274/proyeksi-penduduk-menurut-provinsi-2010---2035.html
[81] Statistics Indonesia (BPS), 2018. East Java Province in Figures 2018.
https://jatim.bps.go.id/publication/2018/08/16/9999b727d316c006ee2fd7e7/ provinsi-jawa-timur-dalam-angka-2018.html
[82] Ibid: Firmansyah et al., 2018.

people per km^2 in Pakal sub-district to around 40,207 ppkm^2 in Simokerto (2020)[83]. Household size varies around the provincial average of 3.6 persons.

Key urban challenges include: the provision of affordable housing, tackling environmental pollution and improving urban mobility.

City Population: 3.15m[84]

Population density: 9497 people/km^2

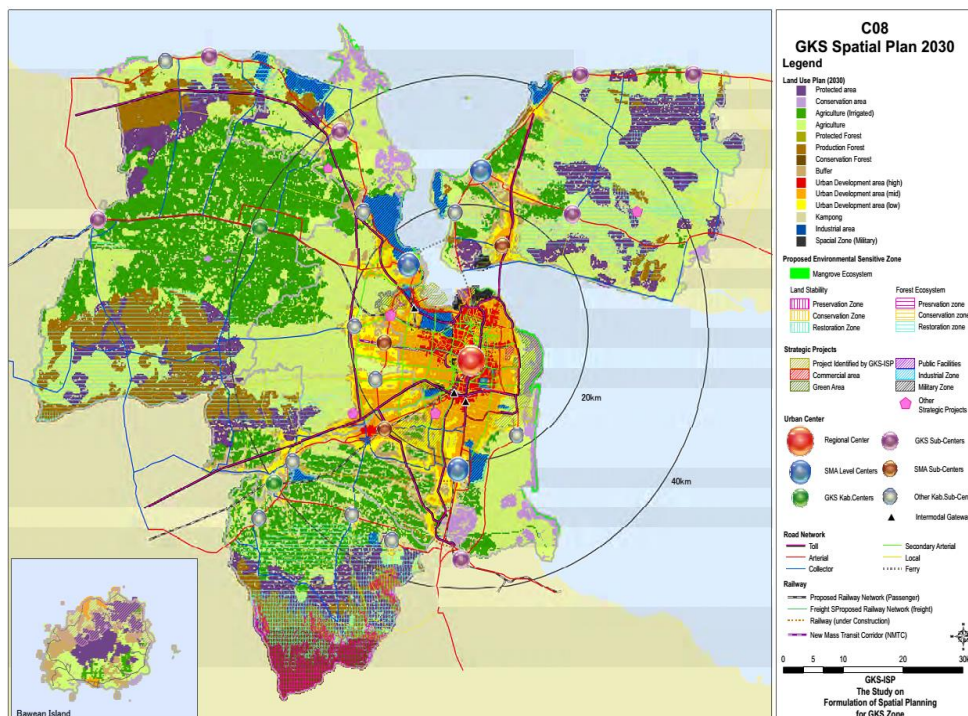**Surabaya Human Development Index:** 0.822 (0.707 national)[85]

Figure 29. Greater Surabaya 2030 land use planning. Source: JICA, 2011.

[83] Surabaya Statistics, 2020. Surabaya Municipality in Figures 2020, Delivering Data to Inform Development Planning. https://surabayakota.bps.go.id/publication/2020/02/28/ac4e22728a5e13cab80af39b/kota-surabaya-dalam-angka-2020--penyediaan-data-untuk-perencanaan-pembangunan.html
[84] Ibid: Surabaya Statistics, 2020.
[85] Statistics Indonesia (BPS), 2020. Human Development Index by Regency / City 2010-2019. https://www.bps.go.id/dynamictable/2020/02/17/1771/ indeks-pembangunan- manusia-menurut-kabupaten-kota-metode-baru-2010-2019.html

4.5 Economy

National

Indonesia has the largest economy in ASEAN with a GDP of around $1tr and 5% average annual growth (2000-2015)[86]. Indonesia has been classified as a lower middle-income country since 2003 and is expecting to enter the top 10 largest global economies by 2025. Long term trends of increasing labour productivity, income, and greater access to education and essential services are expected to continue in future.

The effects of Covid-19 have cut the 2020 growth forecast to 2.5%[87], though this is likely to rebound strongly in 2021.

Key economic and development challenges include tackling economic inequality and making further gains in reducing poverty, especially among the more vulnerable islands.

GDP: $1.04tn

GDP per capita: $3,894

| **Economy by Sector:** | Agriculture – 13% | Industry/Construction – 41% |
| **(2017)** | Services – 45% | |

City

The island of Java represents about 60% of national production. As the provincial capital of East Java Province, Surabaya is a regional centre for economic growth and activity. Development has been rapid with annual production increasing 6% in 2019, and overall growth from $22.1bn in 2012 to 38.4bn in 2019. The city economy is relatively diverse, split between retail (28%), manufacturing (18%) accommodation, food and beverages (16%), and construction (9%) sectors, with smaller contributions from ICT, finance, transport and other services[88]. Surabaya also has a substantial informal sector accounting for 22% of employment in 2013[89]. Historically Surabaya has always been an important seaport and it remains the 2nd busiest in Indonesia, carrying over 3.8m container units in 2018[90].

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[86] Ibid: World Bank, 2020.
[87] ADB, 2020. Asian Development Outlook 2020. https://www.adb.org/publications/asian-development-outlook-2020-innovation-asia#:~:text=Developing%20Asia%20will%20suffer%20a,reaccelerate%20to%206.2%25%20in%202021.
[88] Oxford Business Group, 2019. Surabaya's Strategic location connects east and west. https://oxfordbusinessgroup.com/analysis/soaring-surabaya-second-tier-city-capitalising-its-strategic-location-providing-connections-between
[89] Ibid: Ostojic et al., 2013.
[90] Lloyds List Maritime Intelligence, 2019, No. 43: Tanjung Perak Port. https://lloydslist.maritimeintelligence.informa.com/LL1127925/43-Tanjung-Perak-Indonesia

Unlike many cities, the commercial and business districts of Surabaya are spread over a wide area, almost 30km². Most of these commercial concentrations are also in close proximity to the Surabaya River representing a short leakage pathways.
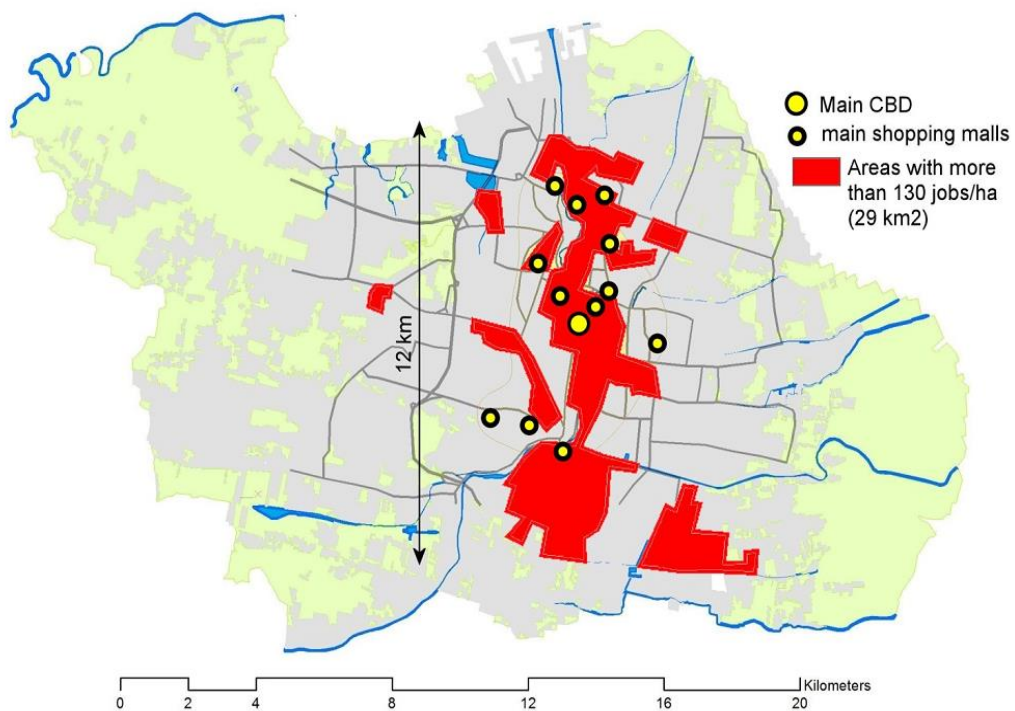
GDP: $38.4bn[91]

GDP per capita: $12,190

Figure 30. Surabaya economic hotspots. Source: World Bank, 2012

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[91] Ibid: Surabaya Statistics, 2020.

4.6 Governance

National

Indonesia's unique geography and diverse population are administered through a decentralised government system. Introduced in 2000 this system gave greater authority, responsibility and resources directly to local districts and municipalities[92]. Development planning and trajectories therefore vary by region but despite a lack of local capacity at first, decentralisation has not created any major political or economic problems. In total Indonesia is composed of 34 provinces which are subdivided into 514 second level districts (regencies) and cities.

National environmental policy is developed under the jurisdiction of the Ministry of Environment and Forestry while waste management is the responsibility of the Ministry of Public Works and Public Housing.
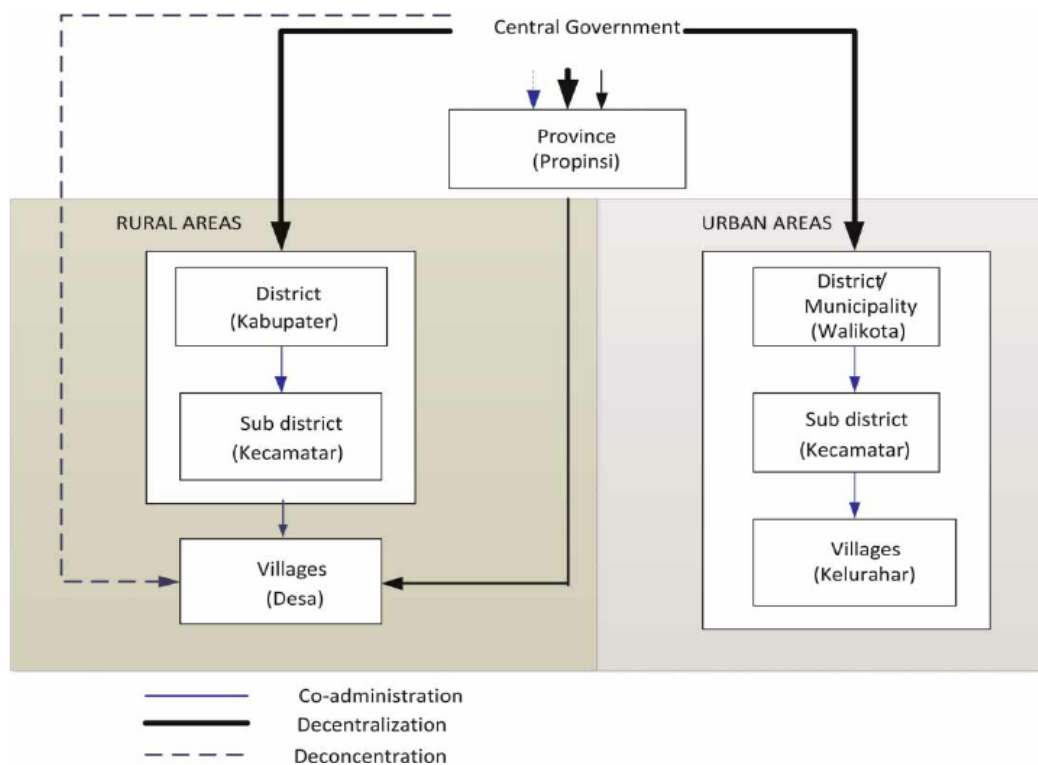

Figure 31. Indonesian governance structure. Source: Simanjuntak et al., 2012

City

The Surabaya City Government (Pemerintah Kota Surabaya) is responsible for city administration. Urban management is structured in 4 tiers: 31 districts, 154 villages, 1368 community associations,

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[92] ADB, 2016. Government decentralization program in Indonesia. https://www.adb.org/publications/government-decentralization-program-indonesia

and 9118 neighbourhood associations. Each community association must bring together at least 4 neighbourhoods, while each neighbourhood association requires at least 40 households. This comprehensive hierarchal structure allows for the utilisation of local knowledge and democratic engagement. Similarly the establishment of Social Information Groups (Kelompok Informasi Masyarakat) has been used to facilitate two-way engagement between the public and city government. Progressive leadership, comprehensive development planning and strong community engagement has allowed Surabaya to achieve among the highest environmental standards among Indonesian cities, previously winning the UN Global Green City award in 2017. In 2019 over 20,000 civil servants were employed across Surabaya municipality[93].
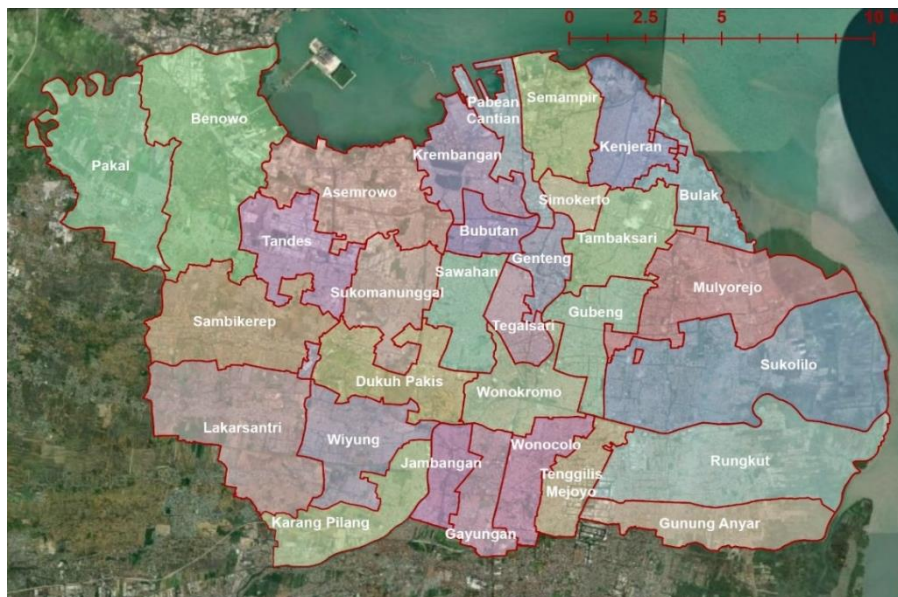

Figure 32. Surabaya administrative boundaries.

Transboundary Considerations

The wider Surabaya metropolitan areas (Gerbangkertosusila) consists of seven cities and regencies over 5,926km^2. Hydrological linkages to the expansive Brantas River Basin means wider institutional coordination is required to improve water quality. The Brantas transects 15 regencies and municipalities and is managed by the state-owned Brantas River Basin Management Corporation[94] (PJT I). Responsibilities include operation and maintenance of existing river infrastructre, implementing water allocation and promoting environmental sustainability. High flood risk means there is already precedent for up and downstream cooperation with several community and transboundary flood warning systems already established (CBFEWS). The PJT I also develop decadal development master plans to provide common understanding and objectives.

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[93] Ibid: BPS Surabaya, 2020.
[94] World Bank, 2005. 'Institutional and Policy Analysis of River Basin Management: The Brantas River Basin, East Java, Indonesia. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=754192

4.7 Key Plans, Policy and Regulations

Urban Development

National Long-Term Development Plan 2005-2025.

Indonesia's ongoing development plan aiming to achieve three overarching goals for: a developed and self-reliant; just and democratic; and peaceful and united Indonesia. Also defines waste sector service targets for cities and provinces.

National Policy and Strategy for Developing Solid Waste Management Systems. 2017-2025

A roadmap to improve national waste reduction and recycling. Key national targets include achieving a 30% waste reduction and total 70% processing rate by 2025.

Spatial Planning of Surabaya 2009-2029.

Developed by the city government to guide urban development. The vision statement aims to create a 'smart, clean, and ecologically friendly' city.

Surabaya Drainage Masterplan 2018-2038.

Longterm city plan for managing flood and urban drainage infrastructure in Surabaya forecasting rapid economic and population growth.

Environment[95]

Act No. 32/2009 concerning Environmental Protection and Management

This regulation defines the planning, utilization, control and enforcement of environental protections in Indonesia. Includes water and waste quality standards and a nguiding framework for environmental conservation.

Law No. 18/2008 regarding Solid Waste Management.

The first comphrehensive waste law for Indonesia. Established the principles for SWM service provision, allocation of responsibilities, incentive and disincentive mechanisms, and penalties for disobeying the law. This covers both household and commercial waste products.

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[95] For a full summary of all Indonesian Solid Waste Management Policy and Regulation, see Appendix 1 of World Bank (2017) City Technical Capacity Support for Solid Waste Management Investment Preparation for Indonesia. Env&Social safeguards.

Indonesia's Plan of Action on Marine Plastic Debris 2017-2025.

National scale strategy to manage plastic waste. Aims to improve stakeholder awareness, management capacity and funding to reduce marine plastics by 70% by 2025.

Surabaya Water Quality and Pollution Management Master Plan

A basin-wide environmental plan established between local, regional, public and private stakeholders. This provides a strong foundation for future cooperation and addressed issues including institutional corruption, regulatory compliance, and local policy engagement.

Surabaya City Environmental Protection and Management Plan.

Defines general environmental targets for Surabaya. Developed by the city government's Office for the Environment.

Coral Triangle Initative 2009

A multilateral partnership of 6 nations to coordinate marine and coastal resource management and conservation in the Indonesian-Philipines and Far Southwestern Pacific ecoregions. Directs action across five areas: the designation and management of 'priority seascapes', the adoption of ecosystem approaches to fisheries, climate change adaptation, marine protected areas (MPAs), and the protection and improvement of threatened species.

Sustainable Development Goals

Presidential Decree No. 59/2017 on Implementing and Achievement of SDGs..

Mandated the SDGs to be integrated into the national and subnational planning process. Led to the the development of a National SDG Road Map which allocated targets across 4 working groups:
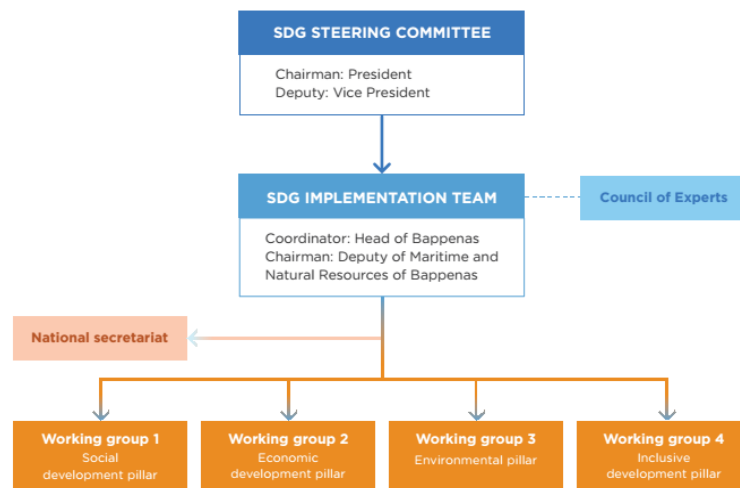

Figure 33. Organisational structure for SDG Coordination in Indonesia. Source: Appendix to the Presidential Decree No. 59 via U NDP, 2017.

Social, Economic, Environmental, and Inclusive Development. The work of Closing the Loop project will progress SDG targets within the Environmental pillar which includes goals 6 and 11-15.

4.8 Key Stakeholders

Governing Institutions

Surabaya City Government

> *Office for the Environment*

> *City Development Planning Agency*

> *Building and Land Management Agency*

> *Public Works Agency*

Ministry of Environment and Forestry

Miistry of Marine Affairs and Fisheries

Ministry of Public Works and Public Housing

International Projects and Donors

UNEP– Mitigating SLCPs from the Municipal Solid Waste Sector

USAID – Municipal Waste Recycling Programme

Private Sector

The Indonesia Olefin, Aromatic and Plastic Industry Association (INAPLAS)

Packaging and Recycling Association for Indonesia Sustainable Environment (PRAISE)

Indonesian Plastic Recycling Association (ADUPI)

Indonesia Packaging Federation (IPF)

5. Nakhon Si Thammarat, Thailand

5.1 Overview

Nakhon Si Thammarat City is the capital of the Nakhon Si Thammarat Province in Southern Thailand. It is a regional hub for commercial activity, tourism, education and culture. The wider province is largely rural with urban development concentrated in the Mueang Nakhon Si Thammarat District, a lowland region located on the province's eastern coast. Nakhon Si Thammarat Province is home to 1.5 million people, 102,152 who live in the Nakhon Si Thammarat City Municipality, and has a total economic production estimated at $5.4 billion, growing at around 2.2% per year. The regional economy is driven by a thriving tourism industry and received over 4 million visitors over last year. The city also has significant religious and historical importance, first founded over 1,500 years ago.

Nakhon Si Thammarat Provincial Hall has overall responsibility for city governance and administration, while district, sub-district and village level policy implementation is delivered through a series of local organisations.

Developing effective waste management systems is a key priority for Nakhon Si Thammarat. The province currently has the largest accumulation of unmanaged solid waste in Thailand with the city regularly receiving waste from surrounding settlements. Its close proximity to the coast and hydrological connection via a large urban canal network mean tackling the city's plastic waste has major regional impact potential. Current development priorities for Nakhon Si Thammarat include developing public awareness and environmental education around waste management, tackling urban flooding, and improving city infrastructure.
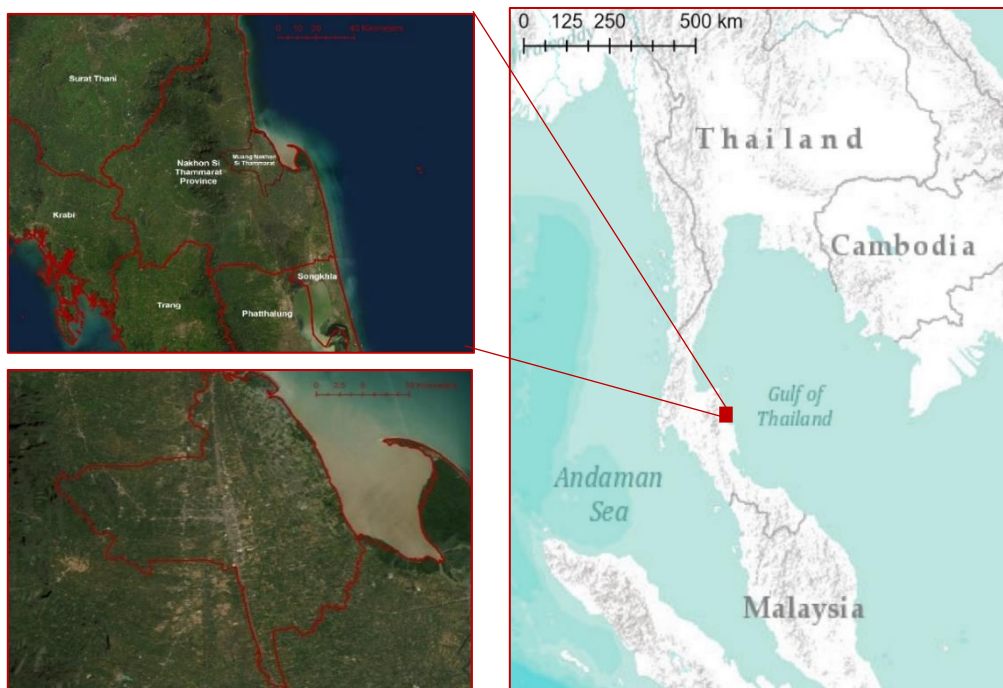

Figure 34. Mueang Nakhon Si Thammarat District satellite overview.

5.2 Environment

Location: Eastern Malay Peninsula, Southern Thailand

Provincial Area: 9,943 km^2 **City Area:** 22.6 km^2

Climate System: Tropical Monsoon

Average Yearly Precipitation: 2,292 mm (49 – 510 mm)

Natural Resources

Water

Nakhon Si Thammarat borders the Gulf of Thailand along 225 km of coastline. The capital, Mueang Nakhon Si Thammarat is a low lying settlement located 15 km inland, north-west of Pak Nakhon bay. The city's water resource are largely composed of an expansive network of canals and streams that stretch from the city into the surrounding rural areas. This includes the Tha Wang, Tha Sak, Bang Luang, Na Muang, Pa Lao, Suan Luang and Khu Pai Canals, several of which run through the city's commercial and residential zones. These then empty into the Gulf of Thailand via a number of branching rivers, primarily the Plai Bang Khwai, Pak Nakhon and Tha Sak.

The extensive canal networks in Southern Thailand were first developed following an extreme flood season in 1988. Heavy losses of life, property and agricultural land that year instigated a series of infrastructure reforms aiming to manage flood risk and water resources across the region. Over the last 50 years there has been significant infrastructure investment from the Office of Natural Resources and the Royal Irrigation Department, completing over 50 projects since 1974[96]. A major flood mitigation project was completed in 2018 and created a series of new diversion channels and floodgates to control drainage.

Other important rivers in Nakhon Si Thammarat Province include the Tapi River which runs 230 km from the Kaholuang Mountains through to Surat Thani, and the Pak Phanang River that travels 156km from the Khao Bantad Mountains into Pak Nakhon Bay.

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[96] Office of the Royal Development Projects Board, 2020. Summary of Royal Development Project in Nakhon Si Thammarat. http://www.rdpb.go.th/rdpb/projectData/files/south/summary_roy_southProject62.pdf

Key environmental challenges for Nakhon Si Thammarat include water quality degradation (driven by wastewater, municipal waste and agricultural pollution[97]) and urban flooding. Flood events driven by extreme rainfall or tropical storms are common and have been recorded each year from 2016 - 2019[98]. Often these environmental stressors combine where high flood discharge washes waste off the land and into nearby water bodies and discharging into the ocean.
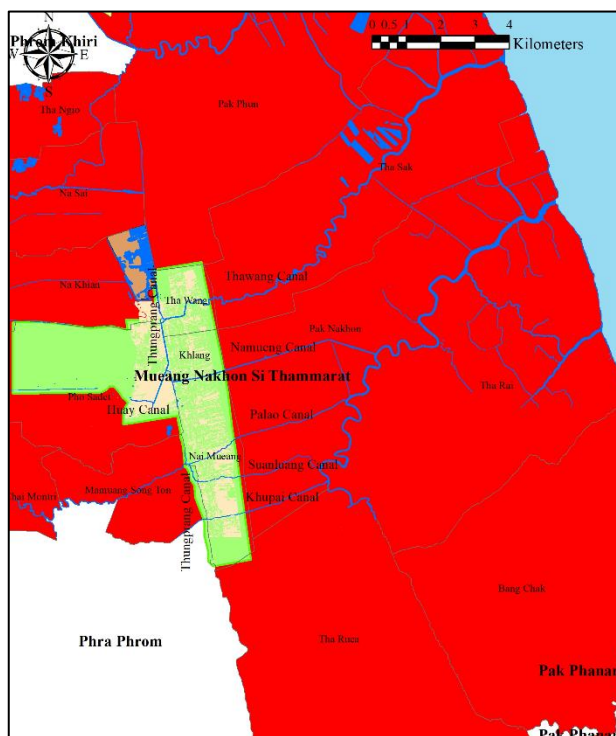

Figure 35. Nakhon Si Thammarat Water Resource Map. Source: Dr Jompob Waewsak, 2020.

Forests

Thailand has 37% natural forest cover, declining 10% since 2001. In contrast, Nakhon Si Thammarat Province has much a higher coverage of approximately 61%[99]. Similarly biodiversity is relatively high, likely attributed to the Khao Luang national park, 25 km to the west of the city, and expansive peat swamp forest and mangrove ecosystems.

Minerals

Nakhon Si Thammarat Province has several mining operations in the upland regions, including for tin, tungsten, barite and feldspar, however this plays a relatively small role in the provincial economy. In

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[97] Steele, C. L., Pumphrey, L. M., Longnecker, N. W., & Gelin, R. M. (2014). Development and Initiation of Sustainable Wastewater Management in Nakhon Si Thmmarat, Thailand. https://digitalcommons.wpi.edu/iqp-all/2187
[98] Floodlist, 2020. Floodlist News – Asia. http://floodlist.com/?s=nakhon+si+thammarat.
[99] Global Forest Watch, 2020. Dashboard – Thailand. https://www.globalforestwatch.org/dashboards/country/THA

the past this has also been the cause of significant damage to public health and the local environment due to unmanaged mine drainage[100].

Climate Change

Climate change is expected to increase the risk of coastal and urban flooding, prolong droughts, and cause sea level rise across Southern Thailand[101]. In Nakhon Si Thammarat Province this is likely to place strain on agricultural yields, fishery health and urban infrastructure. Additionally, severe coastal erosion is resulting in increased flood risk and the degradation of aquatic ecosystems. This is a particular concern for the many local residents and businesses which rely on traditional shrimp farming and fishing.
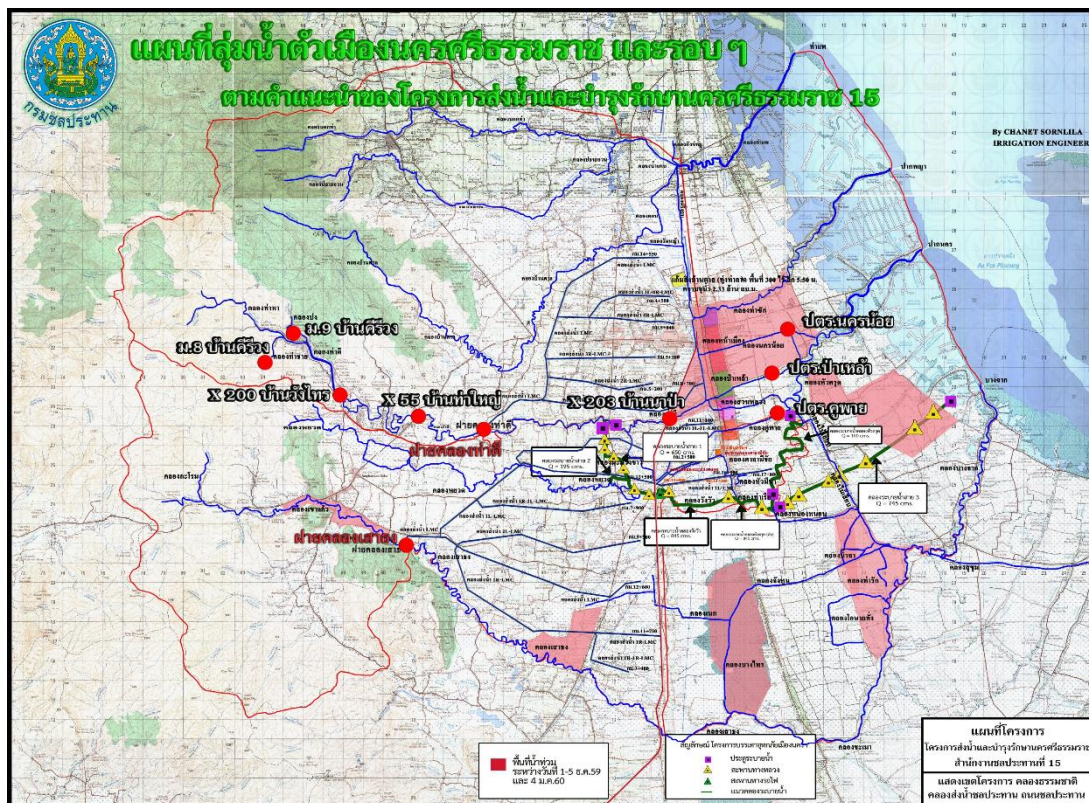

Figure 36. Nakhon Si Thammarat Flood Risk. Source: Royal Irrigation Department

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[100] Eamsakulrat et al., 1994. Hazardous Waste Management in Thailand. TDRI *Quarterly Review*. 9:3 pp.7-14
[101] Marks, D. 2011. Climate Change and Thailand: Impact and Response. *Contemporary Southeast Asia: A Journal of International and Strategic Affairs.* 33. 229-258. 10.1353/csa.2011.0132.

5.3 Services

Waste Management

Nakhon Si Thammarat Province generates approximately 368,388 tonnes of solid waste per year. With very limited local processing and recycling capacity, the majority of this waste accumulates in landfills or illegal dump sites. In 2016 approximately 82% of solid waste ended up in open burning or open dumping while only 9% was recycled.

In line with national policy, municipal waste management in Nakhon Si Thammarat Province is managed by Local Administrative Organisations (LAOs) distributed between 6 regional clusters. These LAOs are formal legal entities and entitled to both generate their own income through public services and receive funding from central government ministries.

However, while 184 LAOs are responsible for collecting and managing solid waste, only 7 have sanitary disposal facilities. With limited waste management capacity the Thailand's Pollution Control Department revealed a provincial accumulation of more than 1.13 million tonnes of solid waste by 2018, out of which 1.11 million tonnes was dumped in Nakhon Si Thammarat City Municipality. This makes Nakhon Si Thammarat the country's number one province for accumulating unmanaged solid waste. Provincial collection coverage is estimated at around 63.5% and though many areas benefit from daily collection increasing service coverage is a priority.

After 2 years of accumulation in landfill, plastic products compose the majority of solid waste piles (56%) followed by organic matter (29%). Of this, plastic bags are the most common form of discarded waste, followed by straws and bottles[102].
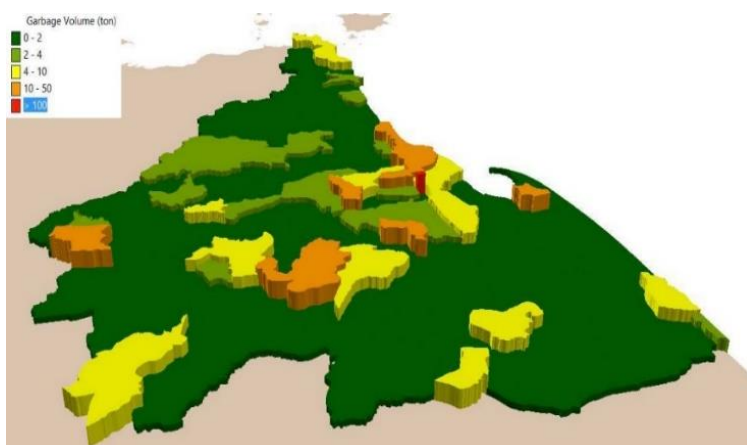

Figure 37. Waste generation distribution across Nakhon Si Thammarat Province. Source: Dr Jompob Waewsak, 2020.
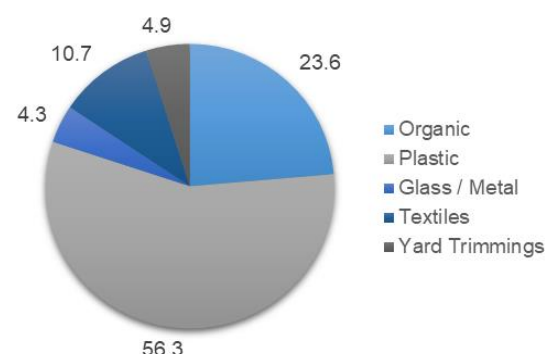

Figure 38. MSW composition at landfill site for 1-2yr accumulations (%). Source: Taskin University, 2018.

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[102] Sanorkan et al., 2019. Plastic Types and Usage by People in Nakhon Si Thammarat Rajabhat University Area, Nakhon Si Thammarat Province. *Wincha Journal*. 38:1

The 22.16ha landfill site is located within Somdej Phra Srinagarindra 84 Park (Thung Thalad), Nakhon Si Thammarat City Municipality. It has been operational since 1977 and receives approximately 261 tonnes of municipal solid waste each day, with over half imported from 58 neighbouring municipalities. A lack of formal management or waste segregation has created significant unsolved health and environmental concerns among local residents and even fish kills. This is especially challenging for an estimated 60 waste pickers who rely on the landfill for their primary income.

In response to the city's growing waste problem a 20MW waste-to-energy plant is in development aiming to process up to 1,000 tonnes of solid waste per day.

Total solid waste generation: 230 – 300 tonnes/day[103]

% Plastic waste: 37 **-** 38%

Digital Readiness

ICT uptake and the modernisation of the public sector plays a key role in the Thailand 4.0 vision set out by national government. In 2018 the Digital Government Development Agency (DGA) was formed with the goal of providing services and support to digitisation of local government administrations. Work so far has included the development of a central e-government portal and app, and the development of the e-Gov Academy to improve ICT human resources.

National Index Score[104]**:** 13.21/25

Global Digital Readiness Rank: 55

Global Networked Readiness Rank[105]**:** 56

Water Provision

Municipal water is supplied by the state-owned Provincial Water Authority. At a national scale this relates to approximately 95-98% access to safe water. Provision is lower in Nakhon Si Thammarat which has 12 water and wastewater plants supplying approximately 91,996 users in 2017. Additionally high levels of non-revenue water loss and climate variability have been known to result in seasonal water shortages.

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[103] Including incoming waste from LAOs.
[104] Ibid: Cisco, 2019.
[105] Ibid: Portulans Institute & WITSA, 2019.

5.4 Society

Thailand has a total population of approximately 66.5 million, of which about 50% reside in urban areas (2018)[106]. However, outside Bangkok which accounts for 80% of the urban population[107], most settlements in Thailand are small to medium sized (<200,000) and widely distributed. Nakhon Si Thammarat Province has a total population of 1.56 million largely residing in rural villages and small settlements.

The capital district of Mueang Nakhon Si Thammarat has an urban population of approximately 157,705 across 60,381 households[108]. The population has remained fairly stable with little migration or growth (0 - 1% per year). The city exhibits a clear linear urban morphology, concentrated along two main roads: Ratchadamnoen Rd, and Highway 401 which connects Nakhon Si Thammarat to the adjacent Surat Thani Province.

Established over 1,500 years ago Nakhon Si Thammarat City has significant historic and cultural value. Religious sites such as the city's giant pagoda and old city ruins, coupled with attractive beaches, draw large numbers of tourists. With its many religious sites the city has been the centre of Buddhism for Southern Thailand since the 17th century. Alongside commercial activity, Nakhon Si Thammarat is also the educational hub of Southern Thailand hosting several public universities and regional campuses.

City Population: 102,152[109]

Average Population density: 4,528 people/km^2 [110]

Human Achievement Index: 0.6163[111]   (0.6218 national)

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[106] National Statistics Office, 2019. Demography Population and Housing Statistics. http://statbbi.nso.go.th/staticreport/page/sector/en/01.aspx

[107] World Bank, 2015. Urbanization in Thailand is dominated by the Bangkok urban area. https://www.worldbank.org/en/news/feature/2015/01/26area#:~:text=In%202010%2C%20the%20Bangkok%20urban,largest%20population%20in%20East%20Asia.

[108] Department of Provincial Administration (DOPA), 2019. Mueang Nakhon Si Thammarat District: Population and Housing Statistics Report 2019 https://stat.bora.dopa.go.th/stat/statnew/statTDD/

[109] Department of Provincial Administration (DOPA), 2019. Nakhon Si Thammarat City Municipality: Population and Housing Statistics Report 2019 https://stat.bora.dopa.go.th/stat/statnew/statTDD/

[110] Calculated.

[111] Office of the National Economic and Social Development Board. 2019. Human achievement index 2019 by National Economic and Social Development Board (NESDB), pages 1-8, ISBN 978-616-235-337
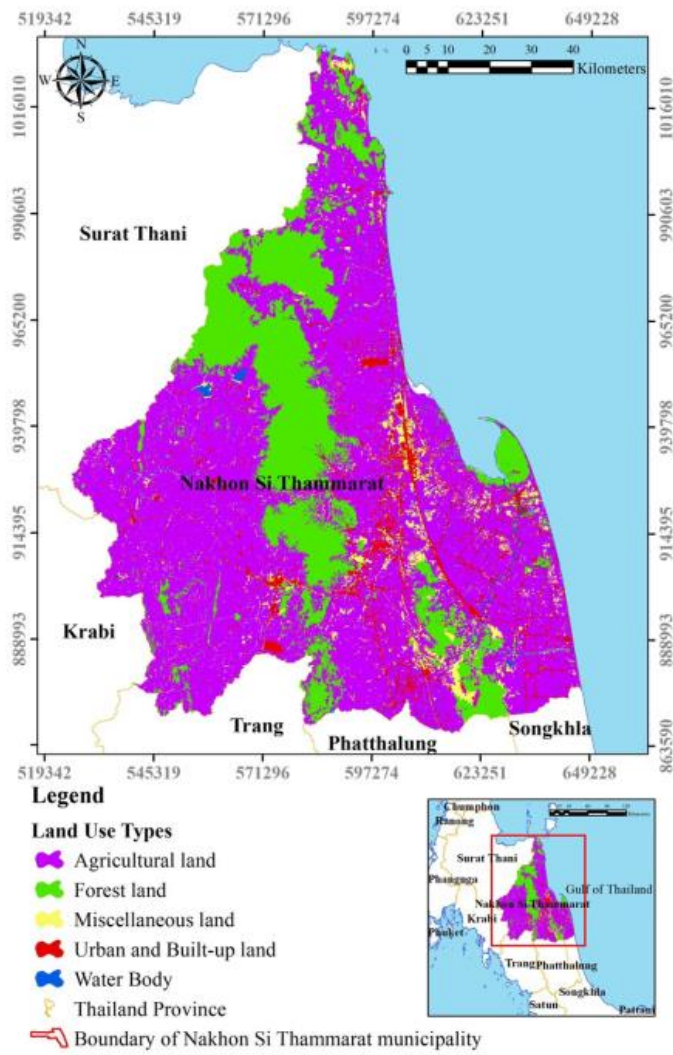
Figure 39. Land use in Nakhon Si Thammarat. Source: Dr Jompob Waewsak, (2020)

5.5 Economy

National

Thailand has the second largest economy in ASEAN, producing around $500bn in 2018. Growth rates in recent years have fluctuated between 3.1 – 4.1% (2015-2018) although in 2019 slowed to 2.4%[112]. Economic activity is primarily driven by the service industry with large tourism, finance and IT sectors, and employs around 40% of the population[113]. The main manufacturing industry outputs include electric components and appliances, rubber, plastics and automotive production.

COVID-19 is expected to have a major impact on the Thai economy due to its reliance on exports, manufacturing and international tourism. Projections suggest a -3 to -5%[114] drop in annual growth though this is expected to rebound to 2.5% in 2021.

Current socio-economic development priorities include: improving human capital, investing in infrastructure connectivity, supporting small to medium enterprises, and increasing technology uptake across the economy[115].

GDP: $543.7bn

GDP per capita: $7467.1

Economy by Sector: Agriculture 8.1%   Industry 35%   Services 56.9%
     (2018)

City

The majority of people in Nakhon Si Thammarat Province are employed in the agriculture sector through plantation, fishery or livestock production[116], and agriculture accounts for 48.7% of land cover[117]. In Nakhon Si Thammarat City there is a more developed service and industry sector. The tourism industry in particular has played a major role in driving economic development. In 2019 the province received an estimated 3.94 million visitors, both domestic and international, generating over $554m in revenue.

GDP: $5.28bn[118]

GDP per capita: $3508

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[112] World Bank, 2020. National Accounts Data. https://data.worldbank.org/country/TH
[113] World Bank, 2016. Thailand Economic Monitor: Services as a New Driver of Growth. https://www.worldbank.org/en/country/thailand/publication/thailand-economic-monitor-december-2016
[114] World Bank, 2020 East Asia and the Pacific in the Time of COVID-19 – Regional Economic Update, April 2020. https://www.worldbank.org/en/region/eap/publication/east-asia-pacific-economic-update
[115] ADB, 2014. Thailand Industrialisation and Economic Catch Up. https://www.adb.org/sites/default/files/publication/178077/tha-industrialization-econ-catch.pdf
[116] Yanwaree et al., 2015. Assessment of Energy Potential of Agricultural Wastes in Nakhon Si Thammarat Province. *Proceedings of 16th TSAE National Conference.* http://www.tsae.asia/2015conf/proceeding/et11.pdf
[117] Kwanmuang, K. 2014. Factors Influencing Farm Investment Planning – A Case Study in Nakhon Si Thammarat province, Thailand. *Journal of Developments in Sustainable Agriculture.* 9:51-55
[118] Office of the National Economic and Social Development Council, 2020. Gross Regional and Provincial Product Chain Volume Measure 2018 Edition. https://www.nesdc.go.th/nesdb_en/ewt_w3c/main.php?filename=national_account

5.6 Governance

National

The Thai government utilises a multi-level governance structure to manage 76 provinces and one special administrative area (Bangkok). These are grouped into 4 geographic regions and internally divided into district, sub-district and neighbourhood divisions. Development is overseen and steered by the Office of the National Economic and Social Development Council under the Office of the Prime Minister, while environmental resource development and protection is overseen by the Ministry of Natural Resources and Environment.
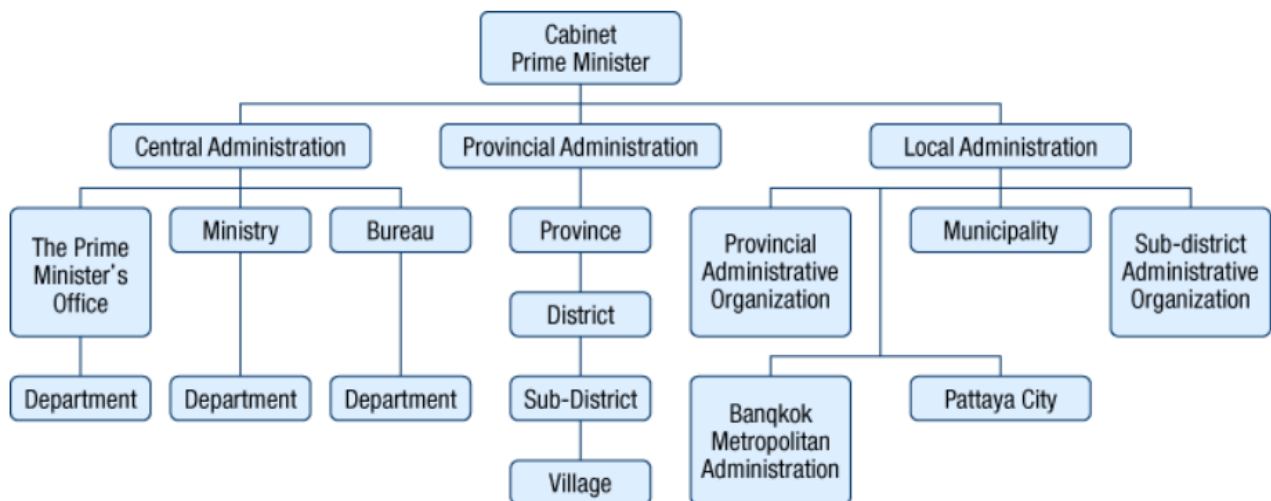

Figure 40. Administrative structure of Thailand. Source: MLIT, 2013.

City

Nakhon Si Thammarat Province is part of the Southern Region and the second largest of its 14 provinces. It is then subdivided into 23 districts which vary in size and population. Governance is overseen by the Provincial Administration Organisation (PAO) and 54 municipal management organisations including Nakhon Si Thammarat City Municipality and the adjacent, Tha Sala, Prom Khiri, Lan Saka, Phra Phrom, Chaloem Phra Kiat, and Pak Phanang Municipalities. Non-municipal areas are governed by 130 sub-district Administrative Organisations (SAOs) and for local administration districts are further divided into 169 sub-districts and 1,552 villages.

Nakhon Si Thammarat City Municipality is part of the Mueang Nakhon Si Thammarat, the province's capital district. It is covers of 5 sub-districts and 65 communities and governed by the Provincial Office for Local Administration.

Transboundary considerations

The canal systems of Mueang Nakhon Si Thammarat create hydrological linkages between the city subdistricts and neighbouring municipalities. Similarly the city's waste management sector is heavily impacted by regional activity. Approximately 51% of waste in the city landfill site is imported from other regions often travelling long distances across the province. With limited city resources strong transboundary coordination and collaborative decision-making is required to best identify investment and policy priorities.

Figure 41. Mueang Nakhon Si Thammarat Municipality Subdistricts.

5.7 Key Plans, Policies and Regulations

Urban Development

Thailand 12th Economic and Social Development Plan 2017-2021.

The overaching framework to guide Thailands development trajectory produced by the Office of the Prime Minister. This is the first 5-year plan of the 2017-2036 National Strategy and sets out national economic, social and environmental goals. Includes a target of 75% waste treatment or resuse and nation-wide improvements in river water quality.

Environment

Enhancement and Conservation of National Environmental Quality Act, B.E. 2535. 1992

Represented a major overhaul of environmental management in Thailand with a greater focus on monitoring and transparency. This established the National Environment Board, Environment Fund and Pollution Control Committee organisations and also mandated the development of environmental quality standards and environmental impact assessments.

Roadmap on Plastic Waste Management 2018-2030

Outlines long-term plastic reduction goals and circular economy targets. Aims to reduce marine plastic waste by 50% by 2027 through development of waste infrastructure, public engagement and education, technological innovation, policy and monitoring. In 2020 this directed implementation of a phased ban on single-use plastics.

National Solid Waste Management Masterplan (2016–2021)

An ambitious waste management plan developed by the Pollution Control Department. Aims for: >75% municipal solid waste managed by 2021, >50% of local governments have systems of waste separation at source, and promotion of the 3Rs among the public and private sector.

Sustainable Development Goals[119]

Mainstreamed through 20 Year National Strategy Framework and the 12th National Economic and Social Development Plan. Administered by the National Committee for Sustainable Development, tasked with formulating national policy and SDG roadmaps and overseeing implementation.

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[119] Ministry of Foreign Affairs, 2017. Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/memberstates/thailand

SDG 11: Thailand has aligned its urban development plan with th New Urban Agenda, prioritising city housing, distaster risk management and upgrading onformal settlements.

SDG 12: Thailand has developed the 'Sustainable Consumption and Production Roadmap 2017 – 2036' to promote growth and the environment. This is framed within the Sufficiency Economy Philosophy and includes investment in waste management, environmental management and freen industry.

SDG 14: Thailand has taken steps to restore coastal ecosystems with ongoing reforestation programmes and ecological management regimes. This accounts for 15.68% of Thailands coastal area with 18,136km^2 marine protected area.

5.8 Key Stakeholders

Governing Institutions

Nakhon Si Thammarat City Government

Ministry of Natural Resources and the Environment

Department of Marine and Coastal Resources

Department of Water Resources

Pollution Control Department

Ministry of Interior

Department of Local Administration

Department of Marine and Coastal Resources

Ministry of Agriculture and Cooperatives

Royal Irrigation Department

International Projects and Donors

GIZ: Improved management of extreme events through ecosystem adaption in watersheds 2016
Implementation of Thai Climate Change Policy into Subnational Level 2017

Private Sector

SCG Chemicals

Thailand Public-Private Partnership for Plastic and Waste Management