CHAPTER 4

THRUST 2 SPATIAL SUSTAINABILITY AND RESILIENCE TO CLIMATE CHANGE

Creating a nation that is resilient to climate change through sustainable spatial management

This thrust has three strategic directions in establishing Malaysia as a country that is resilient to climate change

Long-term spatial planning should take into account the climate change challenges that could affect the sustainability of the country's development in terms of the environment, society and economy. This would offset the impact of the expected rapid development and achieve development that is sensitive and responsive to the effects of climate change, in line with the aspiration to be a resilient nation.

This thrust has three strategic directions in establishing Malaysia as a country that is resilient to climate change

Among the main expected effects of climate change are changes in rainfall distribution, temperature increase and sea level rise that could potentially have an impact on natural habitats, wildlife and food sources. Examples include unexpected floods and droughts, a higher risk of soil erosion, and damage to infrastructure that could affect the country's economic growth and related sectors.

Thrust 2 focuses on the planning, management and use of land resources, and includes mitigation and adaptation measures to curb climate change impacts. It focuses on:

- Management of the resilience of natural ecosystems and their role as a buffer against the effects of climate change;
- Sustainable management of land resources; and
- Emphasis on low-carbon and resilient development in the country's development planning.

Ramsar site in Sungai Pulai, Johor

Strategic directions towards improving the nation's sustainability and resilience to climate change through effective spatial management

The Spatial Sustainability and Resilience to Climate Change thrust has three strategic directions, namely:

SR1 Sustainable Management of Natural, Food and Heritage Resources

The country's resources should be preserved, protected and enhanced in accordance with the principle of sustainable development.

SR2 Holistic Land Use Planning

Land use should be carefully and thoroughly planned to ensure that the economic benefits accrue to all segments of society without harming the environment.

SR3 Low Carbon Cities and Sustainable Infrastructure

The development emphasis is on measures to reduce carbon emissions and the implementation of sustainable infrastructure.

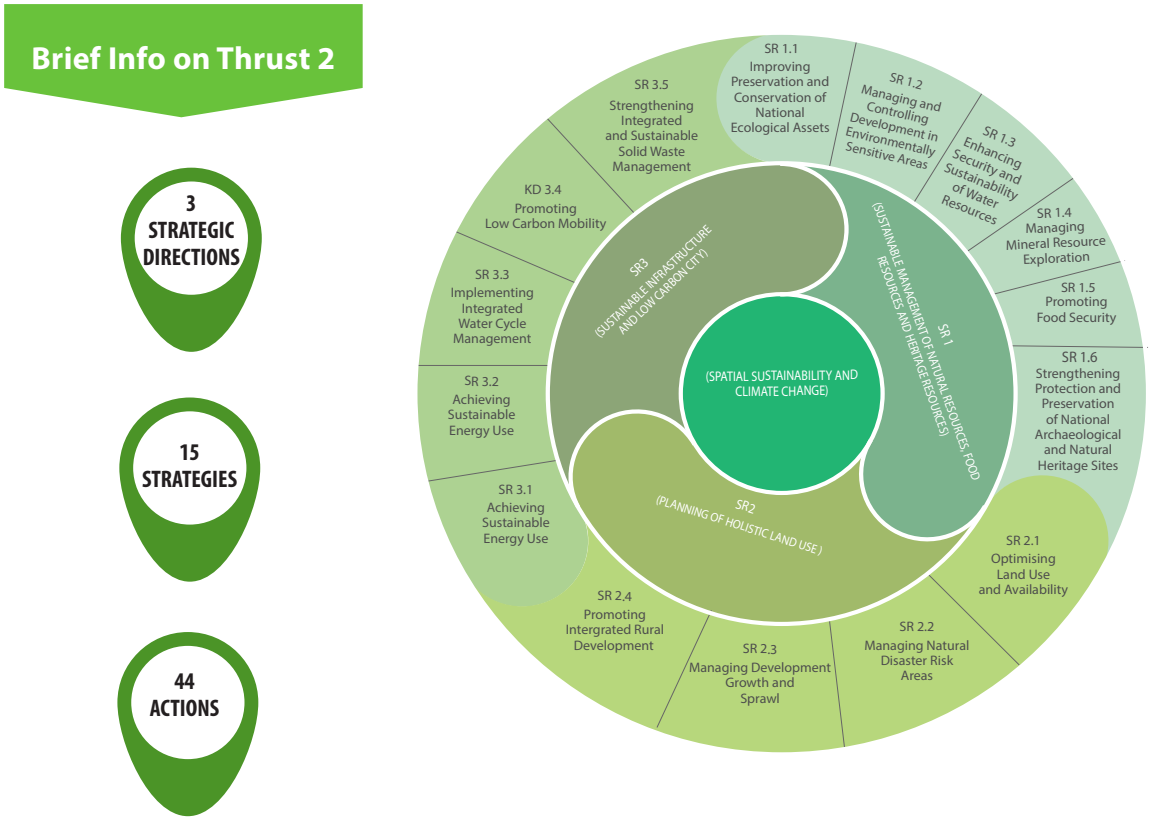
Box 4.1 Malaysia's Performance in Global Rankings on Environment and Climate Change

1. Malaysia was ranked 63rd out of 180 countries in the 2016 Environmental Performance Index (EPI)

Malaysia showed good performance, scoring over 90% for the Biodiversity and Habitat, Health Impacts and Water Quality indicators. The global EPI report suggested Malaysia to focus on water resources, agriculture, fisheries, forestry and climate change and energy issues.

Source: http://epi.yale.edu/

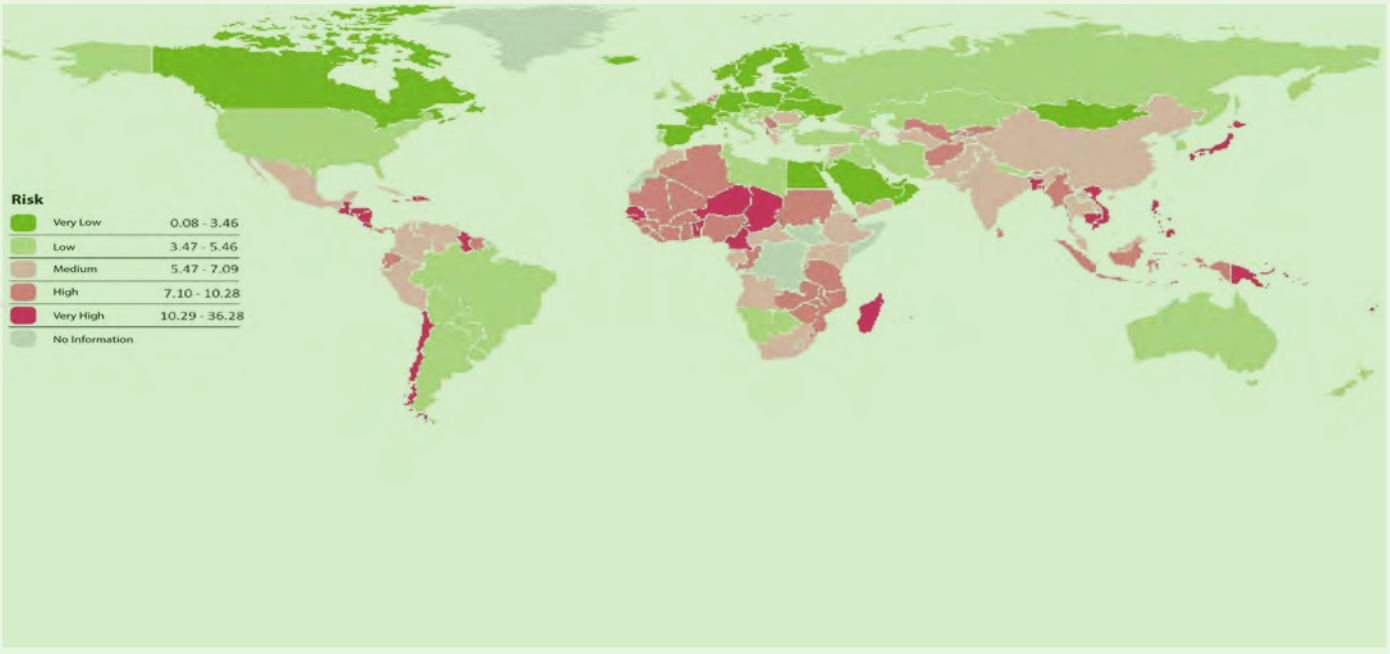
Figure 4.1 Spatial Sustainability and Resilience to Climate Change Thrust



Source: National Physical Plan-3, 2015

Box 4.1 Malaysia's Performance in Global Rankings on Environment and Climate Change (cont'd)

The World Risk Index Report uses a systematic approach to assess a country's level of vulnerability and exposure to natural disasters. In 2016, Malaysia's level of



Source: World Risk Report, 2016

SR1

Sustainable Management of Natural, Food and Heritage Resources

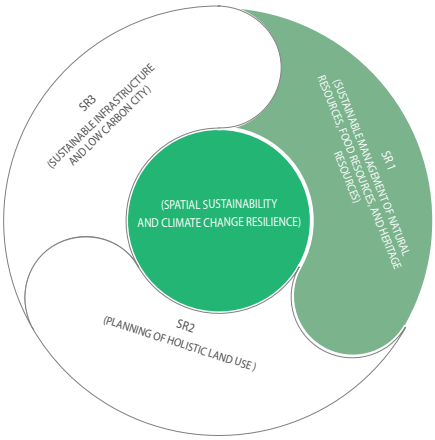
Strengthening the management of natural, food and heritage resources to enhance protection and resilience in support of the country's economic and social development

Natural resources consisting of forests, natural habitats, water resources, mineral resources, agricultural areas for the production of food as well as natural and archaeological heritage sites are national assets that play an important role in the life support system of Malaysians. The NPP-3 emphasises preservation and conservation of these resources, strengthening of ecosystem networks and promoting sustainable use of resources.

Natural resources benefit the people through ecosystem services, clean water supply, and flood and disease control. Ecological assets especially forests are important to ensure continuity of growth and help the country deal with the effects of climate change.

Increased frequency and intensity of natural disasters is one of the effects of climate change that affects the national income and security. The country's resilience to climate change in the future should be enhanced by the preservation and conservation of ecological assets. In addition, the country's important ecological assets are major eco-tourism attractions, directly contributing to the incomes of rural residents.

A mangrove area on Langkawi Island



To complement the sustainable management of natural resources, efforts to improve the conservation and preservation of water and mineral resources are also needed. The country is still dependent on two main types of water sources, namely surface water and groundwater. Development that affects environmentally sensitive areas and climate change effects that impinge on the nation's water resources need to be addressed to ensure the security and sustainability of water resources in the future.

For mineral resources, a more sustainable mining activitiy will facilitate in efforts to protect the environment. Mining activities that are in compliance with the regulations and guidelines that have been prepared would ensure that sensitive ecosystems and residents near mining areas are not adversely affected.

Preserving agricultural areas and upgrading of the infrastructure will increase production, thus enhancing national food self-sufficiency and reducing the country's dependence on food imports.

Nationally significant natural and archaeological heritage sites also need to be preserved, conserved and managed properly. This would ensure that the sites' economic potential, generated mainly through the tourism sector, continues to benefit the national economy.

Physical development planning and implementation that could have potential impacts on the environment must comply with all policies, regulations and guidelines in place to ensure that ecosystem services continue to benefit the nation's sustainable development.

SR1.1 **Improving Preservation and Conservation of National Ecological Assets**

SR1.2 **Managing and Controlling Development in Environmentally Sensitive Areas (ESAs)**

SR1.3 **Enhancing Security and Sustainability of Water Resources**

SR1.4 **Managing Mineral Resource Exploration**

SR1.5 **Promoting Food Security**

SR1.6 **Strengthening Protection and Preservation of National Archaeological and Natural Heritage Sites**

SR1.1: Improving Preservation and Conservation of National Ecological Assets

Malaysia's ecological assets consist of various terrestrial, coastal and marine ecosystems. In terms of spatial management, most of these assets have been gazetted as protected areas, including Permanent Forest Reserves, Fisheries Protected Areas, Wildlife Reserves, Wildlife Sanctuaries, Marine Parks, National Parks and State Parks.

Table 4.1 General Classification of Protected Areas in Malaysia

Area	Type of Protected Area	Act
Peninsular Malaysia	• Permanent Forest Reserve i. Timber Production Forest ii. Land Protection Forest iii. Soil Reclamation Forest iv. Flood Control Forest v. Water Catchment Forest vi. Wildlife Protection Forest vii. Virgin Forest Reserve viii. Recreational Forest ix. Education Forest x. Research Forest xi. Forest for Federal Purposes xii. State Park* • Fisheries Protected Area • Wildlife Reserve • Wildlife Sanctuary • National Park • State Park • Marine Park	• Wildlife Conservation Act 2010 • National Forestry Act 1984 • Fisheries Act 1985 • National Parks Act 1980 • Perak State Park Corporation Enactment 2001 • Johor National Parks Corporation Enactment 1989 • National Park Enactment (Kelantan) 1939 • National Park Enactment (Pahang) 1939 • National Park Enactment (Terengganu) 1939 • National Land Code 1965
Sabah	• Amenity Forest • Protection Forest • Virgin Forest Reserve i. Permanent Forest Reserve ii. Protection Forest iii. Commercial Forest iv. Domestic Forest v. Amenity Forest vi. Mangrove Forest vii. Virgin Forest Reserve viii. Wildlife Reserve • Conservation Area • Wildlife Hunting Area • Wildlife Reserve • Wildlife Sanctuary • National Park	• Sabah Forest Enactment 1968 • Wildlife Conservation Enactment 1997 • Sabah Parks Enactment 1984
Sarawak	• Permanent Forest Reserve i. Forest Reserve ii. Protection Forest iii. Community Forest • Nature Reserve • Wildlife Sanctuary • National Park	• Sarawak Forest Ordinance 1958 • Wildlife Protection Ordinance 1998 • National Parks Ordinance 1998

** In June 2016 the states of Kelantan, Perlis, Selangor, Perak and Penang added this forest classification to Section 10 of the Forestry Act 1984*

Sources:
1. Ministry of Natural Resources and Environment
2. Sabah Forestry Department
3. Sarawak Forestry Department

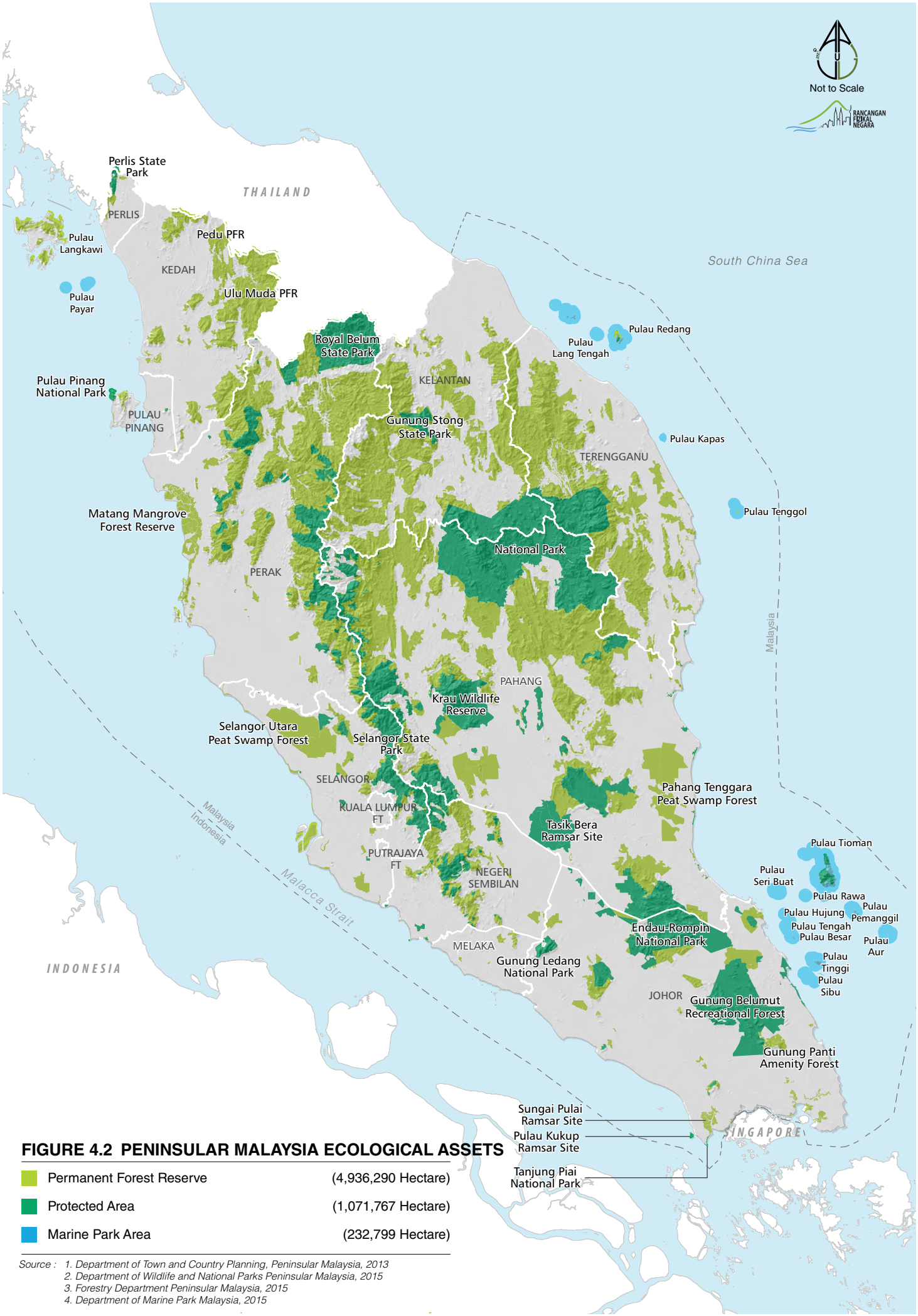


FIGURE 4.2 PENINSULAR MALAYSIA ECOLOGICAL ASSETS

Permanent Forest Reserve	(4,936,290 Hectare)
Protected Area	(1,071,767 Hectare)
Marine Park Area	(232,799 Hectare)

Source : *1. Department of Town and Country Planning, Peninsular Malaysia, 2013*
2. Department of Wildlife and National Parks Peninsular Malaysia, 2015
3. Forestry Department Peninsular Malaysia, 2015
4. Department of Marine Park Malaysia, 2015

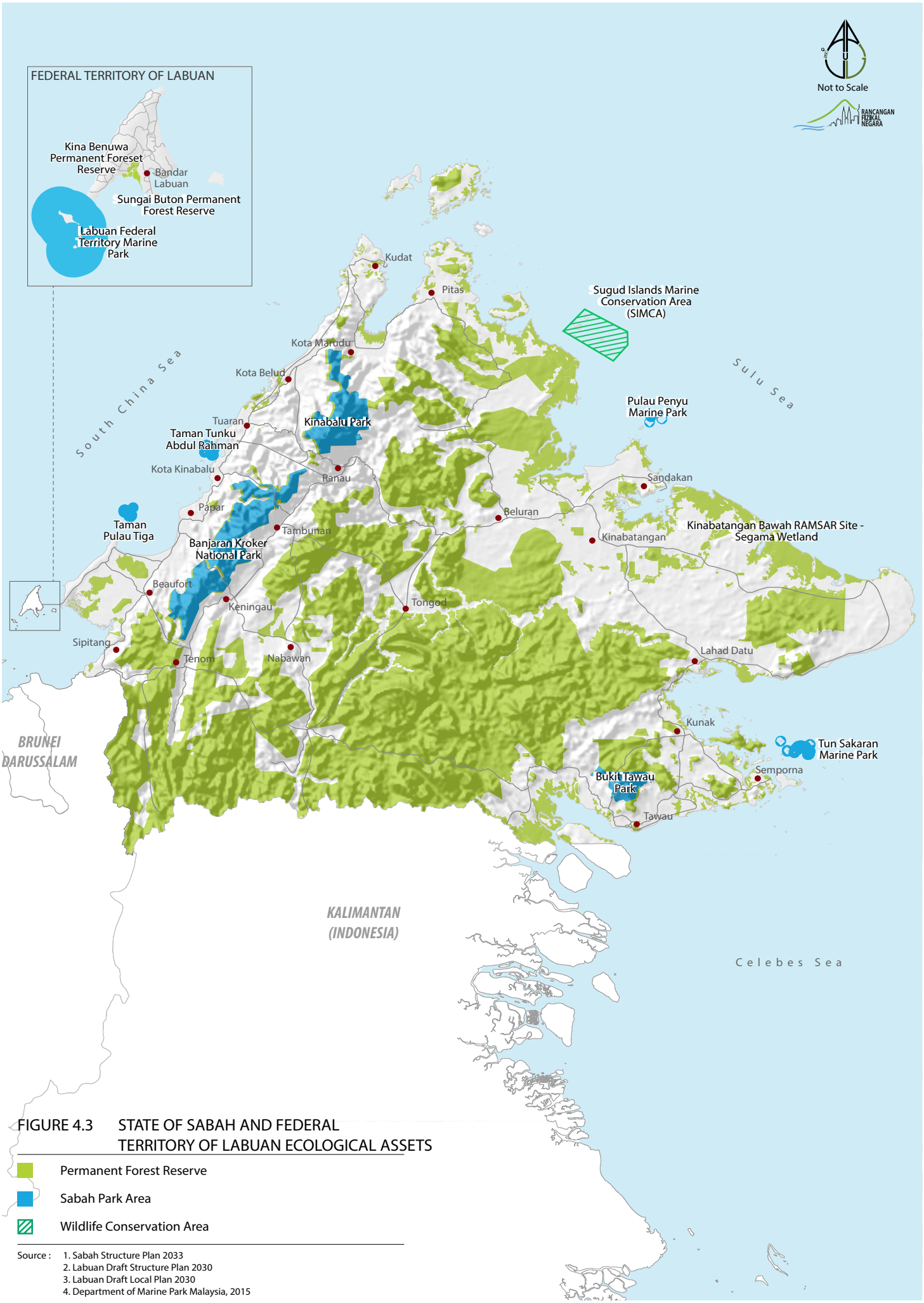


FIGURE 4.3 STATE OF SABAH AND FEDERAL TERRITORY OF LABUAN ECOLOGICAL ASSETS

- Permanent Forest Reserve
- Sabah Park Area
- Wildlife Conservation Area

Source :
1. Sabah Structure Plan 2033
2. Labuan Draft Structure Plan 2030
3. Labuan Draft Local Plan 2030
4. Department of Marine Park Malaysia, 2015

Action SR1.1A
Gazetting threatened habitats as protected areas

Existing protected areas do not fully encapsulate the country's ecological ecosystem, as there are critical habitats that need to be immediately gazetted as protected areas. These important habitats need to be protected from threats of surrounding land development and impacts of climate change, which weaken their ability to provide ecosystem services to humans and resulting in habitat loss for many endangered animal or plant species. This justifies the need to gazette these critical terrestrial and marine habitats as part of preservation and conservation efforts. These habitats include:

1. **Wetlands**
   Wetlands have a rich biodiversity and play an important role in providing ecosystem services such as food resources, raw water, shelter from storms, flood and erosion control, and stabilising the local climate. However, wetland habitats are affected by development of the surrounding land, resulting in their loss and degradation. Fish farming activities, pollution from nearby settlements and industrial areas, realignment of rivers, illegal land clearing and uncontrolled harvesting of forest products are among factors that cause the deterioration of wetlands in the country. To address this issue, important wetland areas should be gazetted as protected areas as a first step towards their conservation. These areas can later accept low-impact development such as eco-tourism, recreation and research to complement the gazettement efforts.

2. **Areas with unique geological features**
   Malaysia has a variety of unique geological features such as limestone caves, quartz ridges, mud volcanoes and hot springs. These areas host unique habitats where endemic animals and plants can be found. Amid development pressures, the threats to these habitats could ultimately lead to the extinction of these unique species. These areas need to be protected and gazetted to ensure that they continue to exist in the future. Initiatives to protect these areas include gazetting them as Global Geopark Sites or World Heritage Sites. The State Government should play an important role in supporting efforts to gazette these areas as part of an agenda that promotes conservation of natural resources, sustainable development and local community development. The Kinta Valley, Jerai, Kinabalu and Kenyir will be developed as National Geoparks in the 2016-2020 period.

3. **Seaweed beds**
   Seaweed beds play an important role as habitat to a variety of marine life, ensuring the stability of the coast and ocean floor and contributing to the coastal ecosystem with their high marine biodiversity. Seaweed protection is essential to ensure the continuity of marine biodiversity resources for traditional and commercial fishing activities. A vibrant traditional fisheries sector can provide a strong economic base to improve the living standards of coastal communities. Most of the seaweed beds in Malaysia are under threat from development activities in coastal areas.

4. **Turtle Landing Sites**
   The turtle population in Malaysia is increasingly threatened by the uncontrolled consumption of turtle eggs and degradation of landing sites for nesting due to coastal development and coastal erosion. Most of the landing sites are still not protected, complicating conservation efforts.

5. **Coral Reefs**
   Coral reefs are estimated to provide economic benefits to the country worth between RM174 million to RM3.6 billion a year. This value includes their contribution to the nation's fisheries resources, eco-tourism and coastal protection, as well as their potential pharmaceutical and aesthetic value. As such, efforts to conserve these areas should be further enhanced.

6. **Migratory Bird Stopover Sites**
   Many species of birds migrate from the northern to the southern hemisphere (or vice versa) through migration flyways and rest at certain stopover sites to feed and reproduce. Each season, water birds stop over at certain water bodies and wetlands in Malaysia, and these sites should be gazetted as protected areas for the migratory birds.

Table 4.2 List of Threatened Habitats That Need to Be Gazetted

Wetlands

1. Setiu Wetlands, Terengganu - This site has various types of wetlands such as peat swamps, mangroves and brackish lagoons that are threatened by development pressures.
2. Peat Swamp Forest, Southeast Pahang - This area is the largest peat swamp forest in Peninsular Malaysia and is facing pressure from land use changes in the surrounding areas.

Areas with Unique Geological Features

1. Quartz Ridge in Gombak, Selangor -- Located in Selangor State Park, it is a habitat for several endemic plant species such as Eulalia milsumi Ridl., Didymocarpus primulina Ridl., Borreria pilulifera Ridl. and Aleisanthia rupestris (Ridl.) (Ridl. Kiew, 1982) ;
2. Merapoh Limestone Hills, Pahang – The karst limestone found throughout the Merapoh area is rich in rare species;
3. Gunung Kanthan, Perak -- The remains of limestone hills here are rich in flowering plant species;
4. Gunung Senyum and Gunung Jebak Puyuh, Pahang – These limestone hills are located in the Gunung Senyum Recreational Forest, which is part of the Jengka Forest Reserve; and
5. The proposed National Geoparks for Gua Musang (Kelantan), Jerai (Kedah), Mersing islands (Johor), Sungai Lembing (Pahang), Kinta Valley (Perak), Lenggong Valley (Perak), Semporna Peninsula (Sabah), Lambir (Sarawak), Gombak (Selangor), Labuan Federal Territory and Kenyir (Terengganu).

Seaweed Areas

6. Tanjung Adang, Pulau Merambong, Sungai Tebrau, Sungai Johor, Pulau Tinggi and Pulau Sibu (Johor);
7. Beting Tengah (Penang);
8. Port Dickson, Batu Empat and Teluk Kemang (Negeri Sembilan);
9. Tanjung Tuan (Melaka);
10. Pengkalan Nangka and Laguna Pantai Biru (Kelantan); and
11. Sungai Kemaman, Cukai, Telaga Simpul, Sungai Paka Lagoon, Sungai Paka riverbanks, Merchang and Gong Batu (Terengganu).

Turtle Landing Sites

1. Ma'Daerah Beach, Chakar Hutang Beach, Geliga Beach, Kijal Beach, Teluk Batu Beach, Pulau Kapas, Mat Kepit Beach, Mak Simpan Beach and Chagar Hutang Beach (Pulau Redang), Tiga Ruang Beach (Pulau Perhentian) and Tanjung Tukas (Terengganu);
2. Cherating Beach; Kuala Rompin; Pulau Aur and Pulau Pemanggil (Pahang);
3. Pulau Upeh, Padang Kamunting, Kuala Sungai Baru and Teluk Gong (Melaka);
4. Pasir Panjang Beach (Segari, Perak); and
5. Kerachut Beach (Teluk Bahang, Penang).

Coral Reefs

1. Islands and rocks around Pulau Lima, Johor;
2. Tanjung Tuan and Pulau Besar in Negeri Sembilan and Melaka;
3. Islands around Pulau Bidan, Kedah; and
4. Islands around Pulau Sembilan, Perak.

Important Bird Sites

1. Coastal areas around Teluk Air Tawar (Penang) - Kuala Muda (Kedah);
2. Mangrove forests around Larut-Matang (Perak);
3. Tanjung Karang - Sekinchan, Kuala Selangor Nature Park and Pulau Indah (Selangor);
4. Islands around Pulau Tioman (Pahang); and
5. Southwest Coast of Johor.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan

Monitoring Agency	Support Agency
• Ministry of Natural Resources and Environment • Ministry of Agriculture and Agro-based Industry	• Forestry Department Peninsular Malaysia • Department of Wildlife and National Parks Peninsular Malaysia • Department of Fisheries Malaysia • Department of Marine Parks Malaysia • Mineral and Geoscience Department Malaysia • Department of Survey and Mapping Malaysia • Department of Director General of Lands and Mines • Land and District Offices
Implementing Agency	
• State Governments	

FIGURE 4.4 PENINSULAR MALAYSIA ENDANGERED IMPORTANT HABITAT

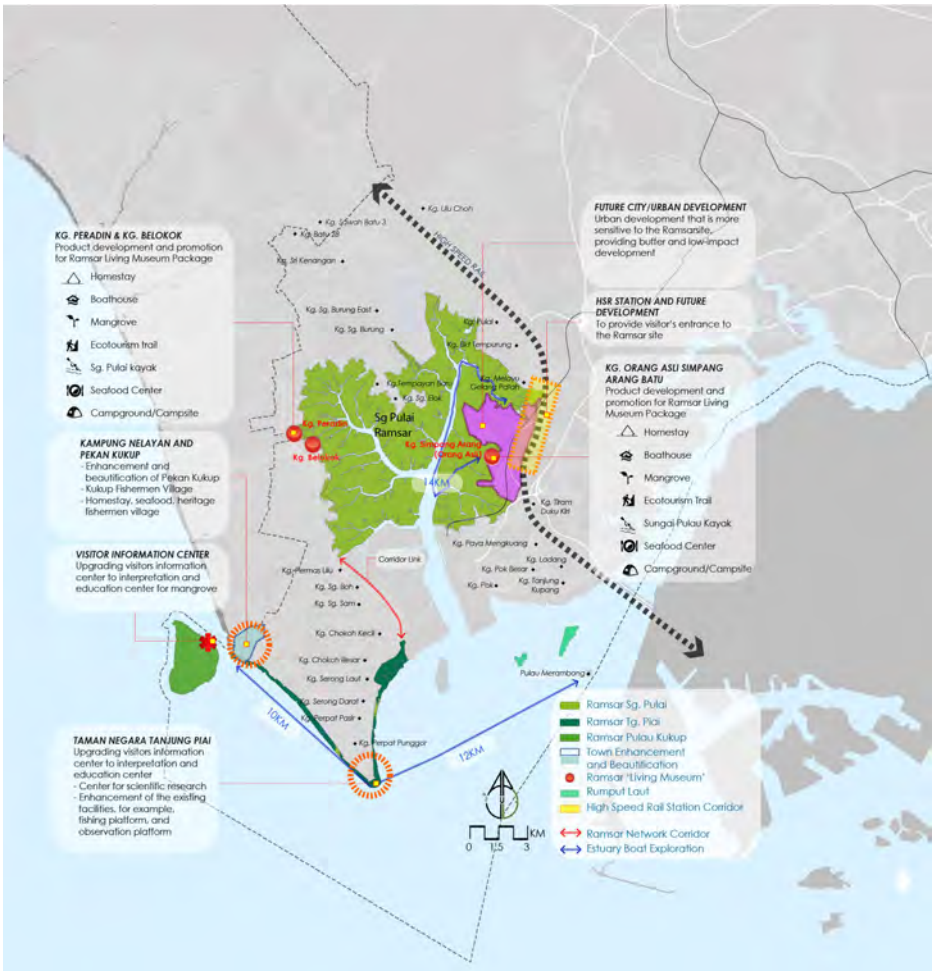
- Bird Stopover Site
- Seagrass Area
- Unique Geological Feature Area
- Quartz Ridge Area
- Turtle Landing Area
- Marine Park Area
- Mangrove Area
- Peat Swamp Area
- Setiu Wetland Area
- Existing Built Up Area

Source : 1. Third National Physical Plan (NPP-3), 2015
2. National Coastal Zone Physical Plan, DTCP Peninsular Malaysia, 2012

Box 4.2 Examples of Development in Threatened Areas

The uniqueness of these areas makes them major tourist attractions for locals and foreigners. However, due to their highly sensitivity towards activities in surrounding areas, eco-tourism is the most suitable economic activity. A study on the areas' carrying capacity should be conducted first before any eco-tourism activity is carried out. Guidelines for Carrying Capacity and Limits of Acceptable Change in the National Ecotourism Plan 1996 prepared by the Ministry of Tourism and Culture can serve as a guide for this study.

1. Ramsar Living Museum - An example of low-impact development in a wetland



The Ramsar sites of Sungai Pulai, Pulau Kukup and Tanjung Piai are turned into living laboratories and natural learning sites where international and local tourists can appreciate and explore the mangrove swamps in their natural habitat.

In addition, tourism facilities and infrastructure in the area demonstrate the functions of mangroves, while public programmes are held to promote volunteer work for the purpose of protecting the mangroves.

Source: Comprehensive Development Plan II, Iskandar Malaysia, 2014-2025

2. Tambun, Perak - An example of low-impact development in a limestone area

The limestone areas surrounding Tambun have been developed into tourist spots. Low-impact development in the area highlights the unique limestone landscape as a tourism attraction. While helping to preserve this limestone area, tourism activities are also a source of income for local residents.

Source: www.thebanjaran.com

Action SR1.1B
Encouraging community involvement in conservation efforts

Communities living in interior areas have a close and very dependent relationship with natural resources such as forest products and water resources. These communities have an important indirect role in helping the preservation, conservation and protection of natural habitats. In the Indigenous Community Conserved Areas (ICCA) approach, which is adopted around the world, local communities are given the responsibility to manage natural habitats in accordance with the management system of their respective community.

Setting up an ICCA involves the gazettement of a protected area, transfer of management rights to local communities and formulation of a community management plan. The ICCA approach is seen as being able to reduce the management burden on government agencies and resolve the issue of land ownership traditionally faced by most communities in the interior. The ICCA approach is also able to handle the issue of intrusion and illegal land clearing and contribute to the expansion of protected areas.

Measures and principles that can be used to make ICCA a success include:

1. **Establishment of ICCA** – An ICCA may be established by local government agencies. Government agencies should play a role to facilitate the process of establishing the ICCA.

2. **Stakeholders involvement** - Involvement of local communities is an important step in building trust among all parties involved. Adequate reference sources and time must be provided to explain the objectives of the proposed ICCA. Government representatives also need to understand the local sentiment in terms of conflicts and priorities. Resolution of any current issues in the proposed ICCA can be used as an opportunity to build confidence among the local communities.

3. **Giving recognition** - Participation by government agencies should not be prescriptive but should be built on the basis of mutual understanding and agreement. Recognition and use of the knowledge of local communities should be the basis for the establishment of the ICCA. The principle of free, prior and informed consent (FPIC) must be respected, with each individual having the right to participate in any decision affecting them.

4. **Determining the ICCA boundaries** - Several approaches can be used to determine the boundaries of the ICCA. Field studies should be carried out together with the local community, where they will be trained in community mapping. This would enable a better understanding of the usage patterns of local resources that will guide the zoning and management of the ICCA.

5. **Implementation of the ICCA** - Local communities should be given an active role in managing the ICCA. Depending on the local situation, the implementation of the ICCA is either through the use of existing laws or through a memorandum of understanding (MoU) between the local community and the government.

6. **Management Protocol** - The main objective for establishing the ICCA is to preserve, conserve and manage natural resources sustainably. The objectives of the ICCA must be clear, based on mutual agreement by the stakeholders. This can then be used for the zoning and management of the ICCA. Support should be given to the local community to establish protocols for the management of ICCA, for example in the development of a management plan.

7. **Technical and financial support** - Most local communities have no access to technical sources and financial assistance to enable them to fully manage the ICCA. Various types of assistance should be made available for them, particularly a capacity building programme. Government agencies should remain as long-term partners and play a role in supporting the local community.

Implementation and monitoring responsibilities

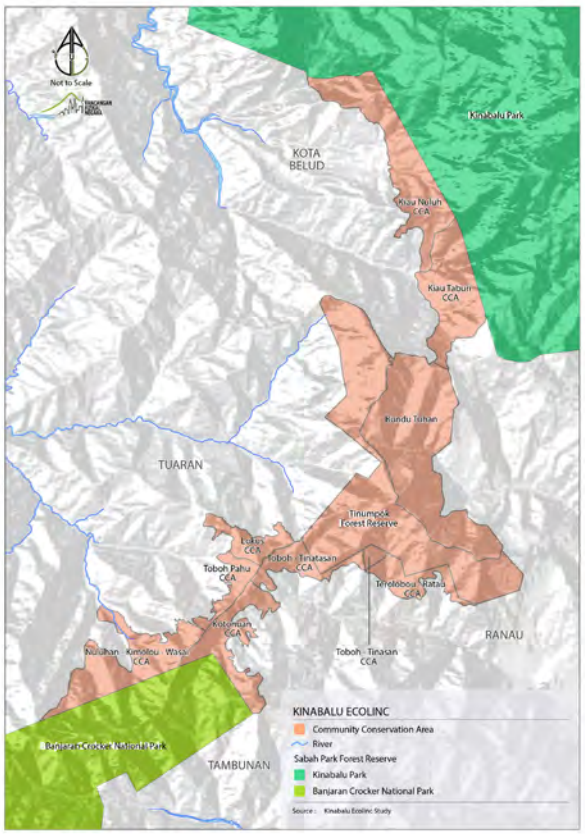
Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Natural Resources and Environment • Ministry of Rural and Regional Development	• Forestry Department Peninsular Malaysia • Department of Orang Asli Development	• Sabah Ministry of Tourism, Culture and Environment • Sabah Parks • Sabah Forestry Department
Implementing Agency		
• State Governments		

Box 4.3 Examples of Community Involvement in Conservation Efforts

An example of an ICCA is Ecolinc Kinabalu, where members of many local communities around Kinabalu Park and the Crocker Range Park were appointed to set up an ICCA for the purpose of developing an ecological corridor between the two parks.

Two zones have been established in this area, namely the Primary and Secondary Areas. Primary areas are totally protected areas where hunting is prohibited and only limited resources are permitted. Secondary areas, known as the Ecolinc Kinabalu Zone, will be managed for sustainable use of resources, eco-tourism and related activities.

The Ecolinc Kinabalu Network



Source: Ecolinc Kinabalu Study 2010-2011

Discussions with stakeholders

Settlements in Ecolinc

Action SR1.1C

Creating and strengthening the implementation of terrestrial and marine ecological corridors

Ecological corridors are an approach to address the issue of the shrinking and isolated wildlife populations in natural habitats. The corridors aim to help wildlife in terrestrial or marine areas to move safely from one habitat to another to reproduce and to find food. The ecological corridor approach helps ensure continuity and enhance the resilience of natural habitats and wildlife populations against the effects of environmental changes. The following measures should be taken:

1. Strengthening the Central Forest Spine (CFS) Initiative

The CFS Master Plan facilitates the establishment of a framework for Environmentally Sensitive Areas (ESAs), realised through the establishment of an ecological network of isolated forest areas. This effort is aimed at creating a balance between development and conservation activities while continuing to benefit society. The CFS Master Plan was prepared following the Second National Physical Plan (NPP-2) in which 17 primary corridors and 20 secondary corridors were identified for implementation. To date, three wildlife crossings or viaducts have been built in CFS1: PL 7: Taman Negara – Tembat PFR, Ulu Terengganu, CFS1: PL 1: Tanum PFR - Sg.Yu and CFS1: PL2: Temengor FR - Royal Belum State Park. State Governments have gazetted some pieces of government land in the ecological corridors as Permanent Forest Reserve (PFR), including Bukit Saiong Forest Reserve (FR), Kedah; Ibam FR - Kedondong FR- Pekan FR – Nenasi FR, Pahang and Amanjaya FR, Perak.

a. Updating and drafting of the State CFS Preservation Action Plan
Most of the information on forest ecological corridors proposed in the CFS Ecological Corridor Network Master Plan in 2010 no longer reflects the actual situation on the ground. The proposed forest ecological corridors are now under threat from development activities and are difficult to implement. The plan should be revised, based on land use mapping and the latest information, in order to determine which forest ecological corridors allow safe passage of wildlife populations. In addition, this plan should be refined at the state level through the State Structure Plan and Local Plan to strengthen its implementation, taking into consideration the development proposals for the area concerned and the existing financial and other resources. This plan should be used as a reference by all government and private agencies involved in land development.

b. Implementation of the proposed CFS ecological corridor
Development of forest ecological corridors involves areas with various categories of land use, and may be implemented through:
   i. Identifying the status of the land to be incorporated, including permanent forest reserve, state land, or land that is privately and individually owned, has a temporary occupation licence (TOL), or is leased, and conducting a study on the flora and fauna as well as habitat preservation;
   ii. Development of infrastructure such as viaducts, electric fences, billboards, speed breakers and sonar lamps;
   iii. Gazetting of state land as part of a permanent forest reserve; and
   iv. Cooperation with external organisations and non-governmental organisations.

c. Implementation of conservation efforts for threatened ecological corridors

A land use study conducted by the Department of Town and Country Planning Peninsular Malaysia in 2014 identified a number of threatened forest corridors where conservation efforts should be undertaken immediately:

Table 4.3 Threatened Forest Corridors

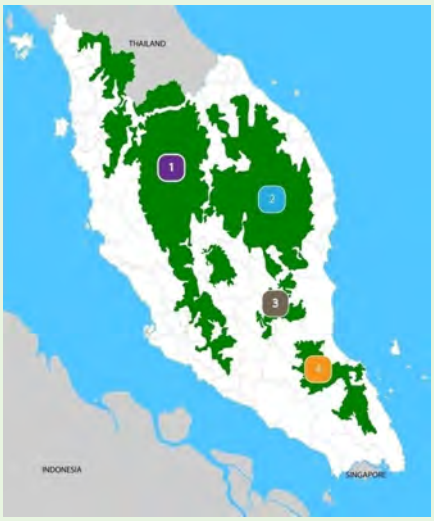
Corridor	Areas Linked	State
CFS1-PL3	Lojing FR – Sungai Brok FR	Kelantan
CFS1-SL2	Krau Wildlife Reserve – Bencah FR – Som FR – Yong FR	Pahang
CFS1-SL5	Taman Negara - Terengganu Coastland	Terengganu
CFS1-SL6	Taman Negara - Chiku FR	Kelantan
CFS2-PL3	Panti FR - Ulu Sedili Selatan FR	Johor
CFS2-PL4	Sungai Marong FR -- Bukit Ibam FR – Lesong FR	Pahang
CFS2-SL2	Chini FR -- Lepar FR	Pahang
CFS2-SL3	Raja Musa FR -- Bukit Tarek FR -- Bukit Gading FR	Selangor
CFS2-SL5	Panti FR -- Kuala Sedili FR Johor	Johor

Source: National Physical Plan-3, 2015

Box 4.4 Central Forest Spine (CFS) Ecological Corridor Network

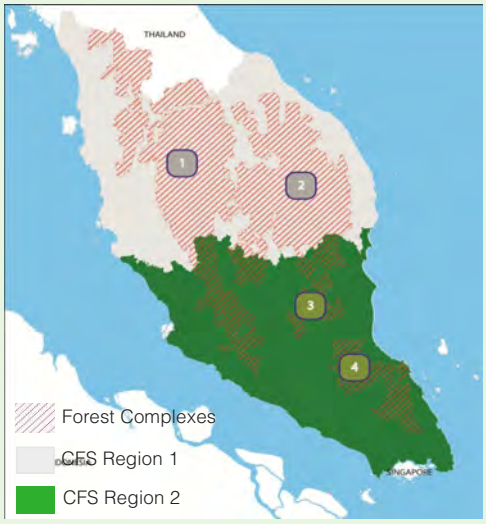
This initiative aims to create networks and corridors between forest areas in Peninsular Malaysia, in order to preserve, conserve and enhance the connectivity among the four main forest complexes.

CFS Forest Complexes, Peninsular Malaysia



1. Titiwangsa Range-Bintang Range-Nakawan Range
2. Taman Negara-Eastern Range
3. Southeast Pahang, Chini and Bera Wetlands
4. Endau Rompin Park – Kluang Wildlife Reserve

CFS Master Plan Area



1. Titiwangsa Range-Bintang Range-Nakawan Range
2. Taman Negara-Eastern Range
3. Southeast Pahang, Chini and Bera Wetlands
4. Endau Rompin Park- Kluang Wildlife Reserve

Source: CFS Ecological Network Master Plan, 2010

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan

Monitoring Agency	Support Agency
• Ministry of Natural Resources and Environment • Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Plantation Industries and Commodities • Ministry of Agriculture and Agro-based Industry	• Department of Director-General of Lands and Mines • Town and Country Planning Department of Peninsular Malaysia • Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN) • Department of Irrigation and Drainage Malaysia • State PERHILITAN offices • State Forestry Departments • Forest Research Institute Malaysia • Land and Mines Offices • Department of Agriculture Malaysia • Land and District Offices
Implementing Agency	
• State Governments • Forestry Department Peninsular Malaysia	

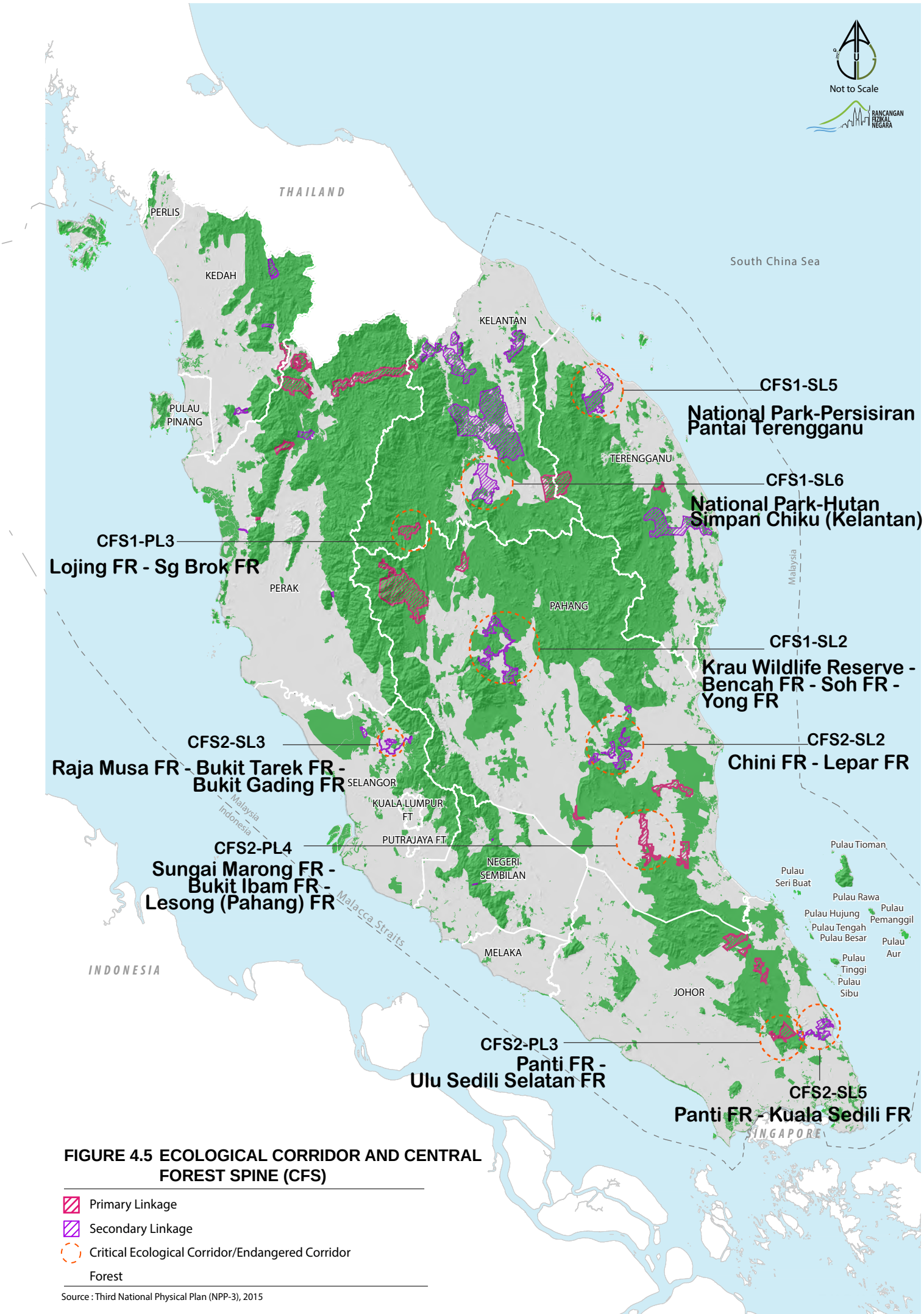


FIGURE 4.5 ECOLOGICAL CORRIDOR AND CENTRAL FOREST SPINE (CFS)

- Primary Linkage
- Secondary Linkage
- Critical Ecological Corridor/Endangered Corridor
- Forest

Source : Third National Physical Plan (NPP-3), 2015

2. Strengthening the Heart of Borneo (HoB) Initiative

The Heart of Borneo (HoB) initiative, signed on 12th February 2007 in Bali, Indonesia, seeks to manage a region located in the plateau at the central of the Borneo Island in perpetuity. This region includes low-lying areas near the borders of Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak). The HoB initiative covers an estimated of 20 million hectares (200,000 square kilometres) in total.

a. Implementation of the proposed transboundany forest corridor

To achieve the HoB goal, several forest corridors, including transboundany forests should be established. They include:

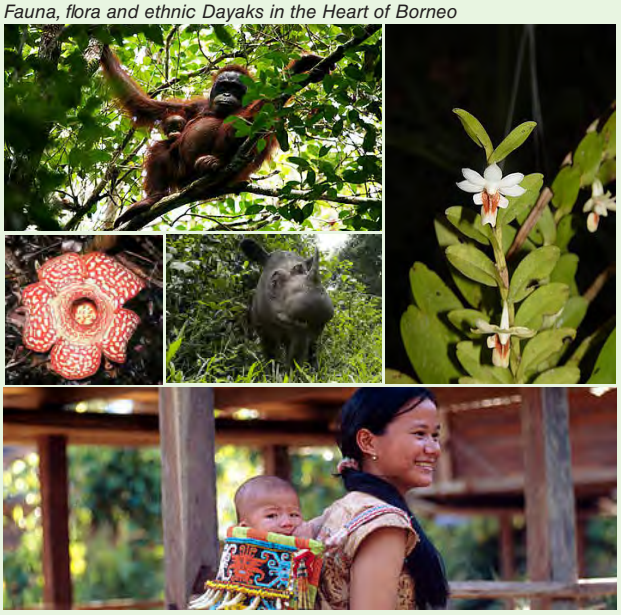
i. Sungai Ingei Protection Forest and Gunung Mulu National Park;
ii. Pulong Tau National Park and Kayan-Mentarang National Park; and
iii. Lanjak-Entimau Wildlife Sanctuary and Betung Kerihun National Park.
iv. Kinabalu Park, Crocker Range and Sipitang (Sabah);
v. Gunung Mulu National Park and Gunung Buda (Sarawak) and
vi. Sg. Katibas-Song (Sarawak)

Box 4.5 - *Heart of Borneo (Borneo)*

The Heart of Borneo initiative covers 3.9 million hectares in Sabah and 2.1 million hectares in Sarawak.

The HoB region is home to about 222 mammal species (including 44 endemic species found nowhere else in the world), 420 bird species (37 endemic), 100 amphibian species, and 394 fish species (19 endemic). The HoB also has a huge potential for the discovery of new species because most of its forest areas are still unexplored.

Fauna, flora and ethnic Dayaks in the Heart of Borneo



Sources:
1. Ministry of Natural Resources and Environment
2. WWF Malaysia

Implementation and monitoring responsibilities

Sabah

Monitoring Agency	Support Agency
• Sabah Ministry of Tourism, Culture and Environment • Sabah Chief Minister's Department	• Sabah Wildlife Department • Sabah Department of Urban and Regional Planning • Sabah Parks • Yayasan Sabah • Natural Resources Office of the Sabah Chief Minister's Department
Implementing Agency	
• Sabah Forestry Department	

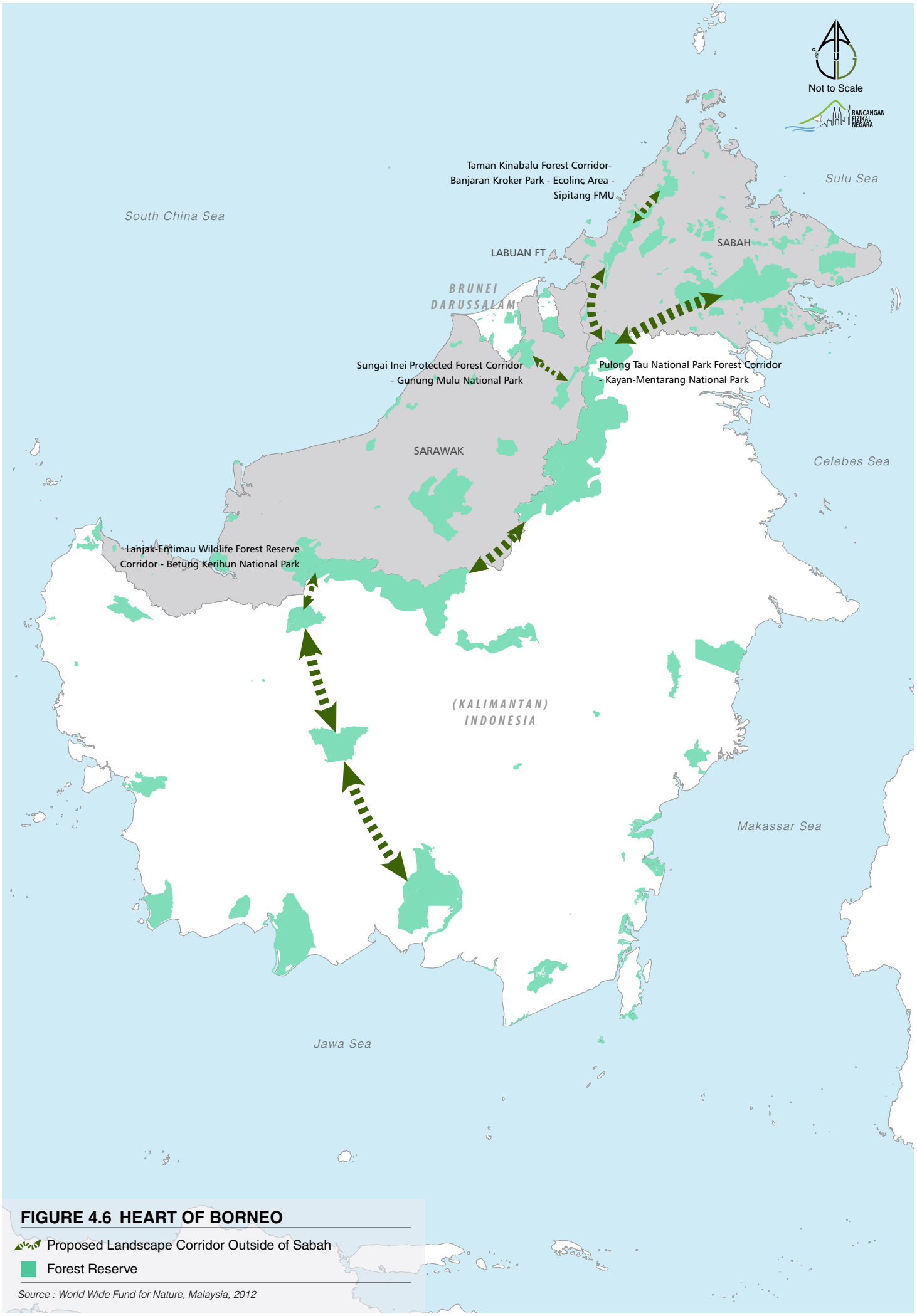


FIGURE 4.6 HEART OF BORNEO

Proposed Landscape Corridor Outside of Sabah

Forest Reserve

Source : World Wide Fund for Nature, Malaysia, 2012

3. Establishment of Marine Protected Area Network

Although coastal and ocean habitats are rich in biodiversity, Malaysian Marine Parks Department data show that only 1.4% of the total area of the waters of Malaysia, or 453.186 sq. km, have been gazetted as protected areas. Identification and maintenance of the network in marine areas is important because a variety of marine species use different habitats throughout their life cycle. For example mangroves, which are part of the marine ecosystem, are a breeding ground for fish and other marine aquatic life because they are quieter and richer in food sources such as plankton.

a. Strengthening control over fisheries protected areas

A Fisheries Prohibited Area is an area that has been gazetted to protect and conserve the population of fish and other marine life under the Fisheries Act 1985 and Fisheries Regulations (Protected Areas) 1994. The implementation of fisheries protected areas should be improved with more robust controls to curb illegal fishing, especially in the following areas

i. Pulau Besar (Melaka);
ii. Tanjung Tuan (Melaka / Negeri Sembilan); and
iii. Rantau Abang (Terengganu)

b. Establishment of marine corridors in Peninsular Malaysia

Marine protected areas that have been established in Peninsular Malaysia do not have strong ecological linkages with coastal habitats. The establishment of marine corridors could increase the effectiveness of marine protected areas and their resilience to the effects of climate change. The main proposed parks are as follows:

i. Terengganu Marine Park - Setiu Wetlands

This area will serve to protect the relationship between the coral reefs around the Terengganu Marine Park (Pulau Redang, Pulau Perhentian and other islands) with the Setiu wetlands.

ii. Pulau Sibu - Pulau Tinggi - Pulau Besar

The islands, located on the east coast of Johor, feature seaweed beds that are an important habitat for dugongs. This marine corridor is intended to provide a protected area for dugong habitats.

Box 4.6 Diversity of Marine Ecosystems

Life cycle of Goliath Grouper, and its linkages to mangrove swamps, coral reefs and coastal waters

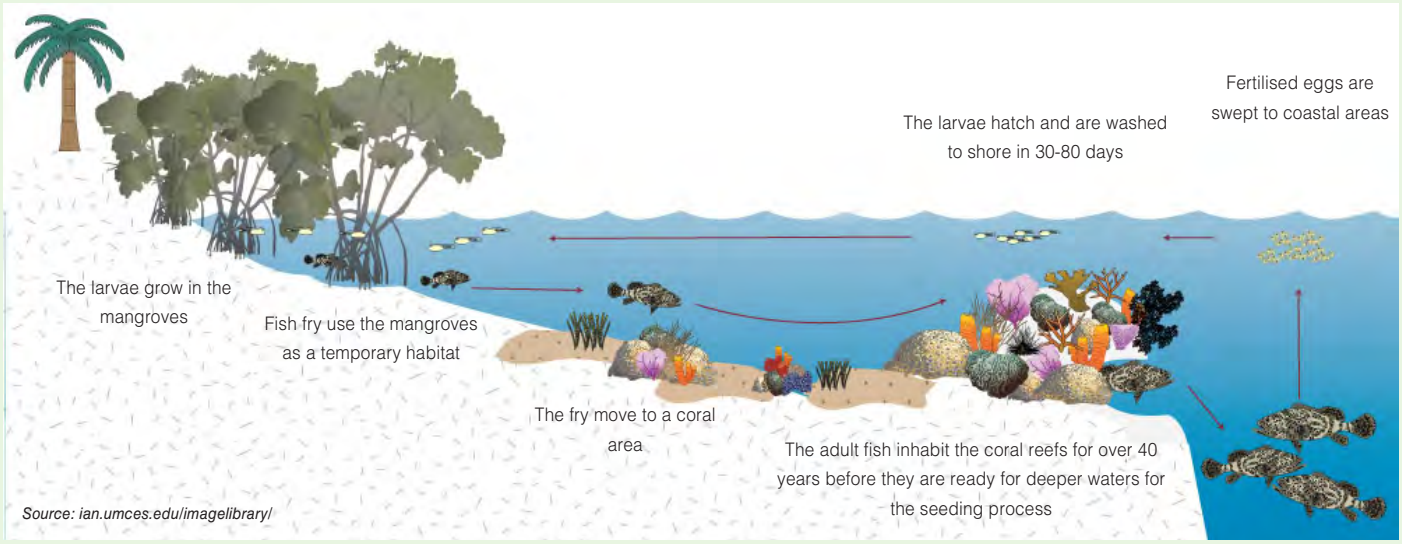
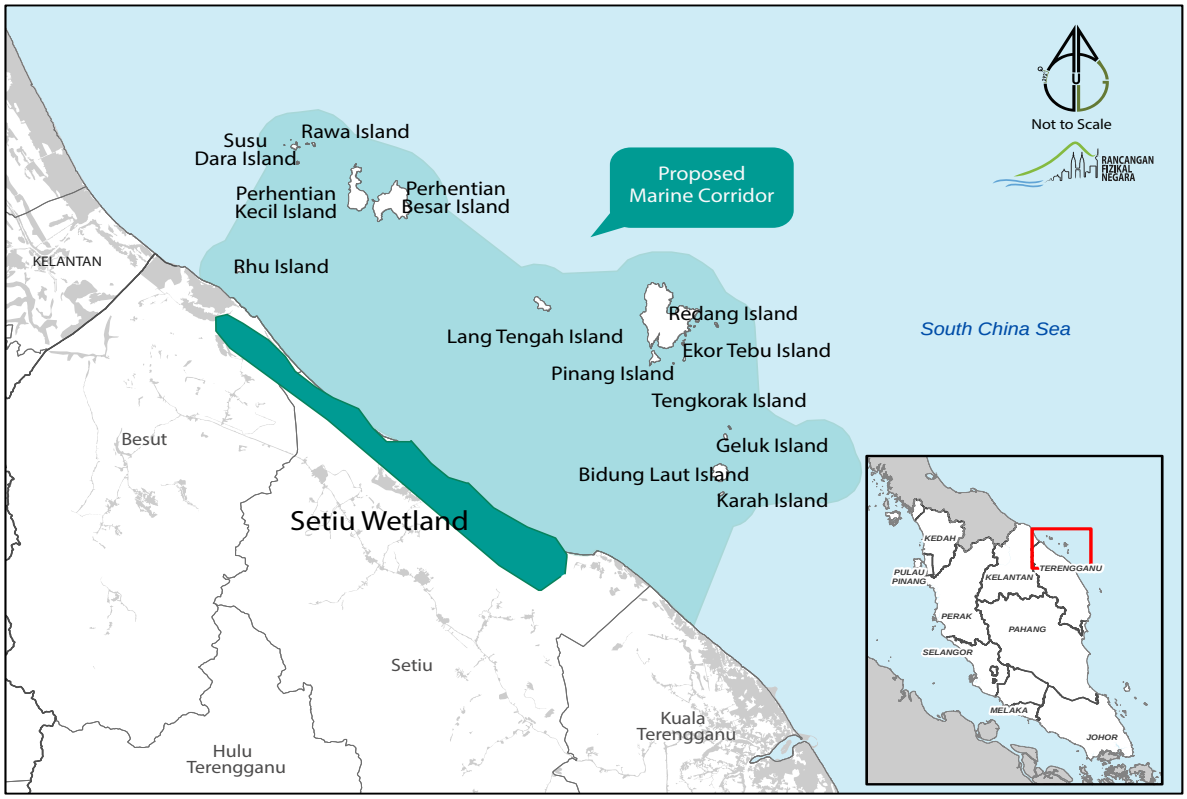
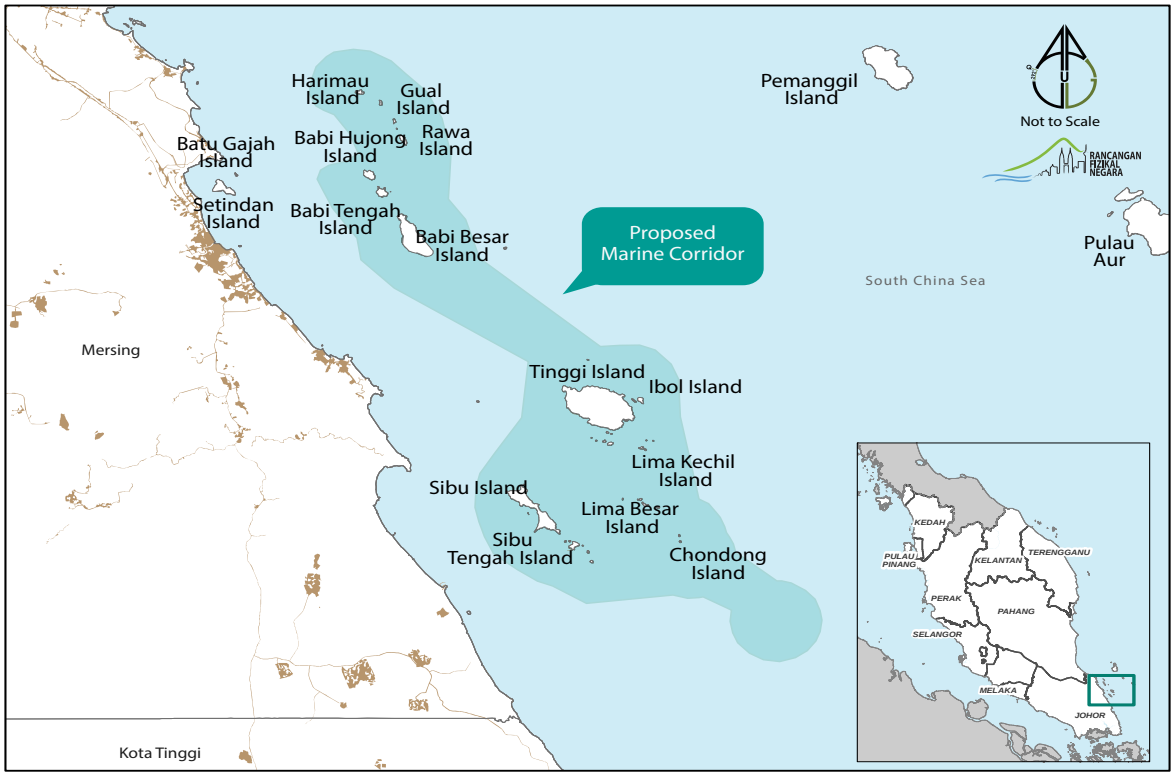


Figure 4.7 Proposed Terengganu-Tanah Lembap Setiu Marine Park Corridor



Source : National Physical Plan-3, 2015

Figure 4.8 Proposed Sibu Island - Tinggi Island - Besar Island Marine Corridor



Source : 1) Dr. Louisa Ponnampalam (Marecet), 2) Reef Check Malaysia 3) Malaysia Marine Parks Department

c. Strengthening the Coral Triangle Initiative in Malaysia

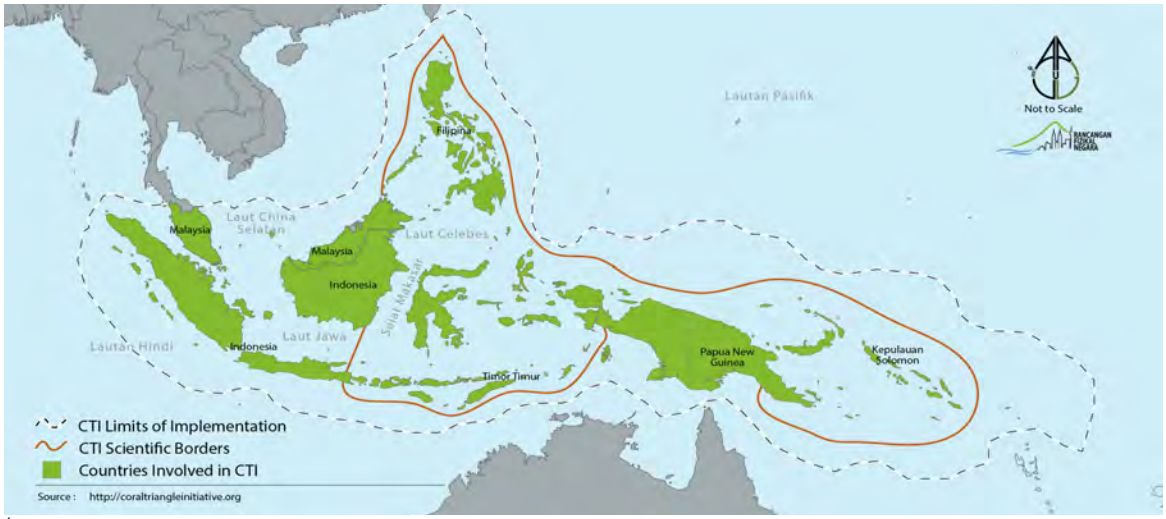
The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) is a multilateral partnership of six (6) countries (Malaysia, the Philippines, Indonesia, Papua New Guinea, Timor-Leste and the Solomon Islands) formed in 2007 to address the urgent threats facing the coastal and marine resources of one of the most biologically diverse and ecologically rich regions on earth. The partnership aims to strengthen the management systems related to marine biodiversity in the CTI member countries. Despite its biological, social and economic importance, the area's coral reefs are under threats from uncontrolled fishing, pollution originating from land and development in coastal areas.

In Malaysia, the Coral Triangle region includes Sabah's coastal areas and waters as well as coastal waters in Peninsular Malaysia's east coast states of Terengganu and Johor. This area is the site of migration for a variety of fish and marine mammals, especially the dugong. Coral reefs in this area are breeding grounds for many species of marine fish. Strengthening the Coral Triangle Initiative would ensure that marine habitats are protected and conserved in a sustainable and effective manner.

d. Trans-boundary Marine Protected Areas

Another approach with the potential to strengthen the management systems of marine ecosystems in the Southeast Asian region is through the establishment of trans-boundary marine protected areas. Some of our country's marine habitats are located close to neighbouring countries. Opportunities for cooperation among neighbouring countries can be created in order to safeguard the interests of the respective countries as well as ensure the sustainability of the shared marine biodiversity. The creation of cross-border marine protected areas can enhance mutual understanding, reduce conflicts of interest, optimise the existing resource capacity, and minimise security threats at national borders. Potential areas include Lawas, Sarawak with Brunei; and the northern waters of Langkawi, Kedah with Thailand.

Figure 4.9 Coral Triangle Initiative (CTI)



[1]Coral Triangle Initiative (CTI) Scientific Borders
Ecoregions and species diversity of reef-building (zooxanthellae) corals of Coral Triangle Initiative (Veron et al. 2009).

[2] Implementation limits of Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF)
This boundary is based on the Exclusive Economic Zone (EEZ) of the CTI member countries. Source data for the EEZ is the Flanders Marine Institute (VLIZ) 2011.
Note: internal borders are not shown, border disputes exist in the map, the borders of Brunei are unknown, and Singapore is not listed as a CTI country. These borders are for illustrative purposes only and are not bound by any law.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Science, Technology and Innovation • Ministry of Natural Resources and Environment	• Department of Marine Parks Malaysia • Department of Fisheries Malaysia	• Sabah Chief Minister's Department • Sabah State Economic Planning Unit • Sabah Parks • Department of Marine Parks Malaysia • Department of Fisheries Malaysia
Implementing Agency		
• National Oceanography Directorate		

SR1.2: Managing and Controlling Development in Environmentally Sensitive Areas (ESAs)

An Environmentally Sensitive Area (ESA) is defined as a special area that is very sensitive to any changes in the ecosystem as a result of natural processes or activities in or around the area, either directly or indirectly. The ESA's sensitivity level is based on three inter-related elements, namely the risk of natural disasters, the value of life support services, and the area's heritage value.

The NPP-2 proposed that ESAs be integrated into the planning and management of land use and natural resources. This is done in several ways, namely:

i. Development plans i.e. the State Structure Plan (SSP) and the Local Plan (LP) should examine the ESAs identified in the NPP-2 for inclusion with other important ESAs at state and local levels;
ii. All ESA borders should be mapped in the SSP and LP, and these boundaries should be marked in accordance with the class on the site;
iii. An adequate buffer zone should be provided between the ESA (Phases 1 and 2) and urban or agricultural areas; and
iv. Permanent Forest Reserves (PFRs) are not to be excised, and forest plantations are only allowed in PFR areas that have been zoned for forest production as agreed to at the 68th National Land Council meeting on 9th August, 2012. The areas cover 439,189 hectares and should not exceed 5% of the total natural forest area over a seven-year period, as stipulated in the standard for forest management certification under the Malaysian Timber Certification Scheme.

However, Local Authorities are still experiencing difficulties in the implementation of the ESA policy as a whole due to several reasons. Firstly, ESA management criteria that have been set for an area do not take into account the planned development status and ownership of existing land. Secondly, the pressure to clear land for development is still high and the ESA management criteria cannot be fully met. This is more critical in an area of high sensitivity or where development activities have a significant environmental impact.The NPP-3 action to strengthen the management and control system of ESA is as follows:

Action SR1.2A
Adopting ESA framework as development control basis

The ESA Framework is an important spatial planning tool to help guide the development of sustainable land use at the local, district and state levels. Tables 4.4 and 4.5 show the ESA framework for Peninsular Malaysia, Sabah and Federal Territory of Labuan. The full adoption of this framework would enhance its implementation in development planning.

Table 4.4 ESA Framework for Peninsular Malaysia

LEVEL 1	
Environmentally Sensitive Areas	**Management Criteria**
1. Existing and proposed Protected Areas (Table 4.1)	• Development, farming or logging is not allowed except for ecotourism, research and education.
2. Threatened Habitats outside Protected Areas: • Turtle landing areas, seaweed beds, coral reefs, limestone outcrops, quartz ridges and migratory bird stopover sites	• Threatened habitats outside Protected Areas should be identified in the State Structure Plan and Local Plan; and • A management plan should be provided with the habitats identified and gazetted.
3. Existing and proposed catchment areas	• Infrastructure facilities other than dam infrastructure are not permitted; and • Logging and agricultural activities are not permitted.
4. Areas above 1,000m contour	• New urban and agricultural development in the highlands is only permitted in the two Special Management Areas (SMAs), namely: i. Cameron Highlands-Kinta-Lojing ii. Genting Highlands-Bukit Tinggi-Janda Baik; • For these two SMAs, new agricultural development is only allowed outside forest reserves and water catchment areas; • New development is not permitted in Fraser's Hill SMA; • Existing developments must comply with the strategies and guidelines outline in the Fraser's Hill Development Coordination Study2; • For highland areas that have been developed, controls should be implemented through the provision of Special Area Plan (SAP); and • All construction and agricultural activities in areas of more than 1,000m contour must fully comply with the existing and future rules and guidelines.
LEVEL 2	
Environmentally Sensitive Areas	**Management Criteria**
1. All forests and wetlands outside of Protected Areas	• Development or agriculture are not allowed. Sustainable logging and low-impact eco-tourism are permitted, subject to local constraints; and • Sustainable logging activities should be emphasised in the monitoring and enforcement.
2. Areas of peat soil, soft soil, sinkholes and former underground mines	• Mapping of this area in the State Structure Plan and Local Plan; and • A feasibility study should be conducted before the site is developed.
3. A 500m buffer zone around ESA Level 1	• The 500m buffer zone should be modified if there is an existing or committed development but control should be provided according to the characteristics of the area; and • Land use inventory should be carried out at the Local Plan level where the buffer zone boundaries should be updated taking into account: i. The existing developments (industryl and agricultural areas, settlements, etc.); ii. The committed developments; and iii. Planning for the construction of critical infrastructure such as highways, railways, electricity transmission lines, etc.
4. Areas between 300m and 1,000m contour	• All construction and agricultural activities in this area must fully comply with existing and future rules and guidelines and • The areas should be identified, mapped and detailed in the State Structure Plan and Local Plan.

Source: National Physical Plan-3, 2015

Table 4.4 ESA Framework for Peninsular Malaysia (continued)

LEVEL 3	
Environmentally Sensitive Areas	**Management Criteria**
1. 500m buffer zone around Level 2 ESA	• Controlled development in which the type and intensity of development should be subjected to constraints such as coastal zones experiencing erosion and areas exposed to the threat of flooding.
2. Water catchment megired intake and groundwater recharge zones	• Water catchment area intake and groundwater recharge zones should be identified in the State Structure Plan and Local Plan.
3. Areas of 150m-300m contour	• All development and agricultural activites in the areas between 150m-300m contour must fully comply with existing and future rules and guidelines.
4. Islands and Marine Parks	• All development on islands and marine parks must fully comply with existing and future rules and guidelines.
5. Coastal Areas	• All coastal development must fully comply with NCZPP, state ISMP and existing and future rules and guidelines.

Source: National Physical Plan-3, 2015

[1]As stated in Act 172, Town and Country Planning Act 1976

Based on the Study on Sustainable Development of the Highlands of Peninsular Malaysia. EPU, Prime Minister's Office, Putrajaya, 2012

[3]DOE, 2008. Development Coordination Study on Bukit Fraser, Pahang. Department of Environment, Putrajaya.

[4]Special Management Plan (Conservation) Kinta - Cameron Highlands - Lojing Highlands, FDTCP, 2012.
Guidelines for Development in Hilly Areas, Ministry of Urban Wellbeing, Housing and Local Government, 1997
Guidelines on Agriculture Development on Sloping Land, Department of Agriculture, 2000
Development Guidelines for Highlands, Ministry of Natural Resources and Environment, 2005
Development Guidelines for Hilly Areas and Highlands, Town and Country Planning Department, 2009
Development Guidelines for Hilly Areas and Highlands for Selangor, 2010
First Schedule, Environmental Quality (Prescribed Activities) (Environmental Impact Assessment), 2015, Department of Environment Malaysia
Safety Guidelines for Hill Site Development, Penang, 2012

[5]Guidelines on Physical Development Planning for Islands and Marine Parks, Town and Country Planning Department, 2014
National Coastal Zones Physical Plan (NCZPP), 2010
National Ecotourism Guidelines, Ministry of Culture, Arts and Tourism, 1997
Erosion Control Guidelines for Coastal Area Development, Department of Irrigation and Drainage, 1997
National Integrated Coastal Zone Management Policy, Economic Planning Unit, 2005
Integrated Shoreline Management Plan (ISMP), State Department of Irrigation and Drainage

Quartz Ridge and Klang Gates Dam in Ulu Kelang, Selangor

Source: Department of Town and Country Planning Selangor

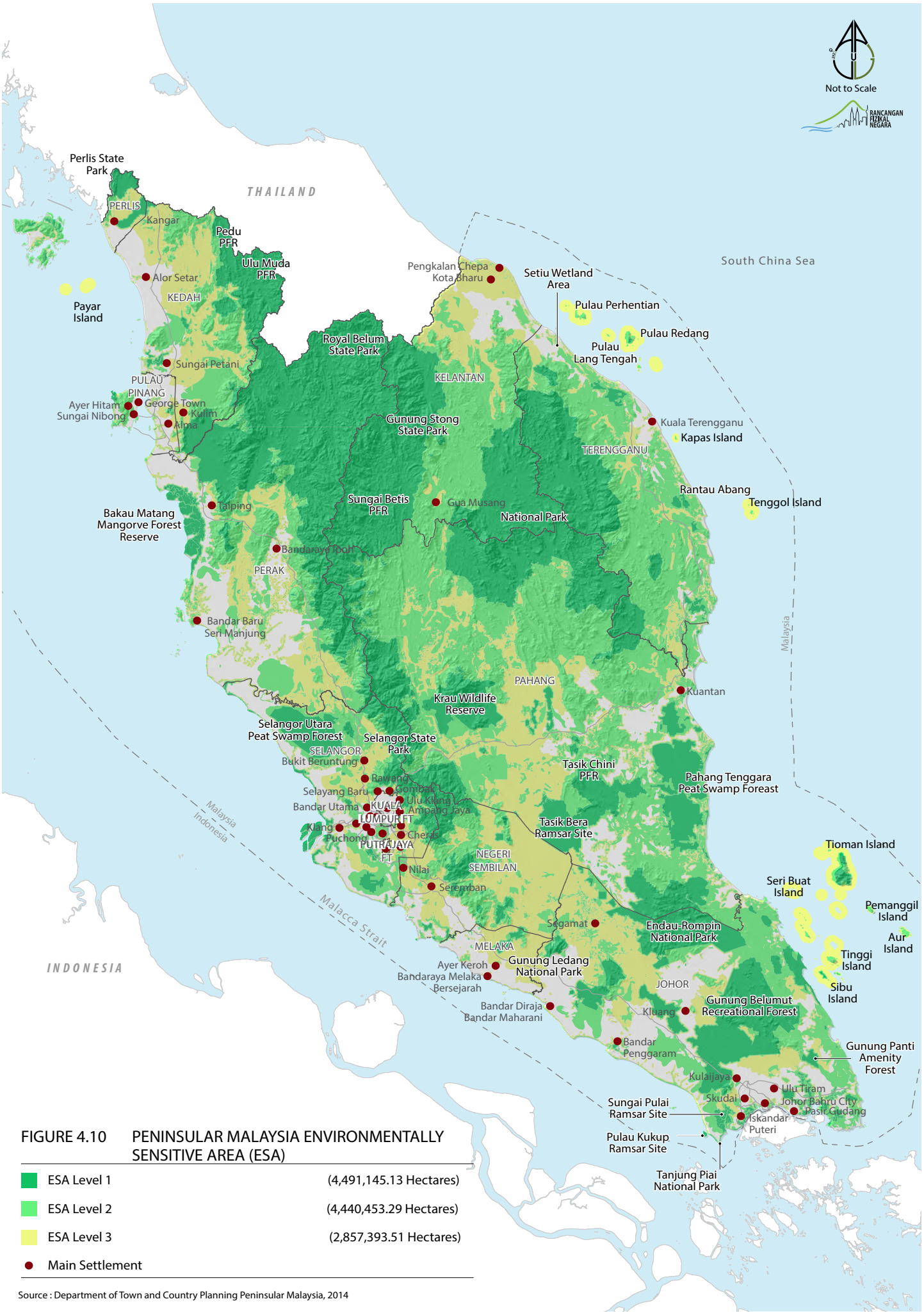


FIGURE 4.10 PENINSULAR MALAYSIA ENVIRONMENTALLY SENSITIVE AREA (ESA)

ESA Level 1	(4,491,145.13 Hectares)
ESA Level 2	(4,440,453.29 Hectares)
ESA Level 3	(2,857,393.51 Hectares)
Main Settlement	

Source : Department of Town and Country Planning Peninsular Malaysia, 2014

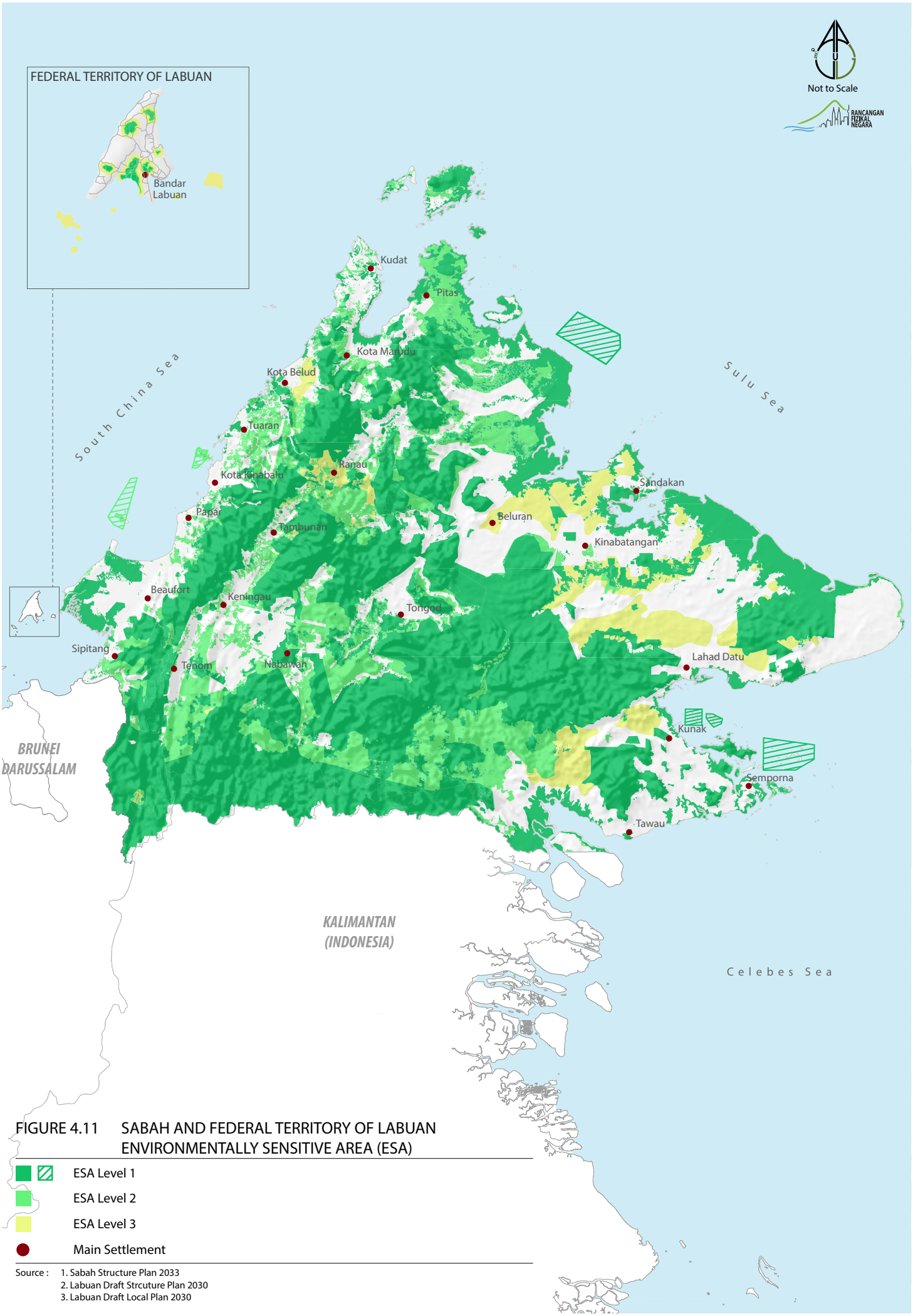


FIGURE 4.11 SABAH AND FEDERAL TERRITORY OF LABUAN ENVIRONMENTALLY SENSITIVE AREA (ESA)

- ESA Level 1
- ESA Level 2
- ESA Level 3
- Main Settlement

Source : 1. Sabah Structure Plan 2033
2. Labuan Draft Strcuture Plan 2030
3. Labuan Draft Local Plan 2030

Table 4.5 ESA Framework for Sabah

LEVEL 1	
Environmentally Sensitive Areas	**Management Criteria**
1. Existing and proposed Protected Areas 2. Main Conservation Areas 3. Catchment areas of existing and proposed new dams 4. Water Protection Area 5. Restricted Development Area under Shoreline Management Plan (SMP) 6. Gazetted Cultural, Historical and Archaeological Sites 7. Areas with geological features and sensitive areas	• Development, agriculture or logging is not allowed except for ecotourism, research and education; • Area in Class II Forest Reserve cannot be converted from natural forests; and • Rehabilitation of natural forests is permitted
LEVEL 2	
Environmentally Sensitive Areas	**Management Criteria**
1. All forests and wetlands outside protected areas 2. Marine Conservation Areas 3. Development in restricted areas under Shoreline Management Plan (SMP)	• Development is not permitted; • Sustainable logging with credible farmers certified under Malaysian Good Agricultural Practices (MyGAP) and low-impact nature-based tourism within the area's carrying capacity are permitted; and • No loss of biodiversity in forests where land use has changed.
LEVEL 3	
Environmentally Sensitive Areas	**Management Criteria**
1. Areas over 1,000m contour 2. Kinabatangan Corridor of Life (KCOL) 3. Water intake catchment area 4. Water Conservation Area 5. Problematic rock formations	• Development is restricted; • Sustainable logging, with credible farmers certified under Malaysian Good Agriculture Practices (MyGAP); and • Controlled development in which type and intensity of development is subject to constraints

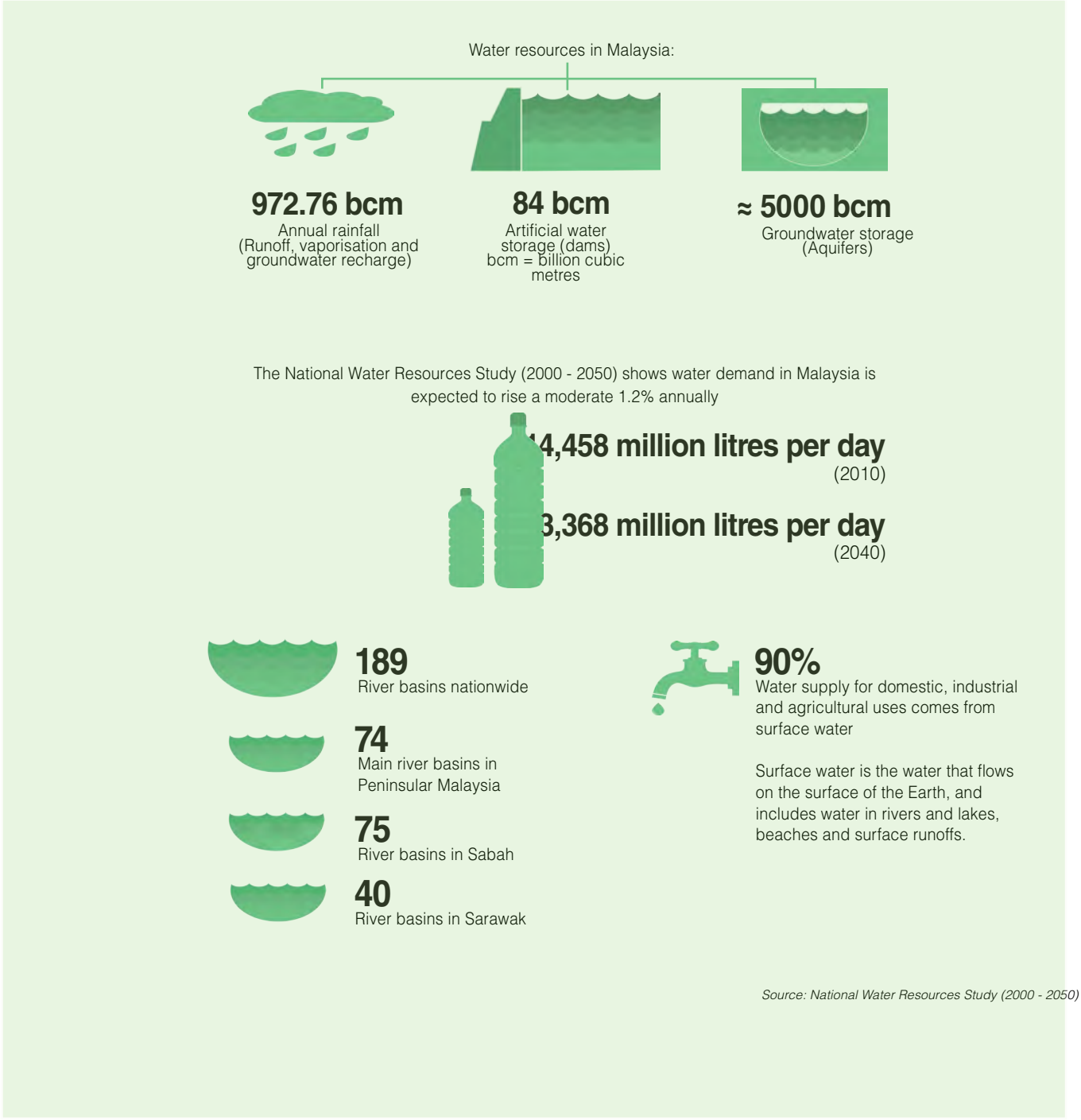
Source: Sabah Structure Plan 2033

Bohey Dulang Island, Tun Sakaran Marine Park, Sabah

SR 1.3 : Enhancing Security and Sustainability of Water Resources

The security and sustainability of water resources is a priority goal as outlined in the national Water Resources Policy (NWRP). At the NPP level, this action is to ensure water resources are preserved over the long term to meet the needs of the population, especially for agriculture, industry, fisheries and water supply. It is also to ensure that it remains available to support the country's development and helps to maintain the ecosystem.

Water resources in the country are aslo facing a variety of issues such as floods, droughts, pollution and climate change effects that require prevention, conservation and adaptation actions. The efficient and effective management of water resources is the main focus to ensure security and sustainability of the nation's water resources.



Action SR1.3A
Strengthening river basin management

River basins are a dynamic region in terms of human activities and land use. They are often threatened by water pollution resulting from the processing of sewage, discharge of industrial effluents, solid waste and soil erosion. According to the Environmental Quality Report 2014, out of the 201 of the 473 rivers monitored, 25 rivers are polluted, with 11 rivers in Class III and 14 rivers in Class IV. This pollution negatively affects water supply, public health and aquatic ecosystems.

1. Gazetting watersheds

Watersheds comprise of river upstream areas still under forest cover and are a source of raw water. Most of these areas have been gazetted as Permanent Forest Reserve, a part of which is reserved as watershed forest. According to the 2014 Annual Report of the Forestry Department of Peninsular Malaysia, 723,495 hectares or 14.9% of Permanent Forest Reserve in Peninsular Malaysia have been gazetted as Water Catchment Forest as of end-2014. According to the 2013 Sabah Forestry Department Annual Report, 836,526 hectares of forest reserve, or 23.14% of the total Permanent Forest Reserve area in the state, have been gazetted as protected forest to protect watersheds.

Efforts to gazette water catchment forest must be redoubled to include all upstream river basins, areas that are a source of raw water as well as catchment areas for existing and proposed dams. This is a major step to prevent inappropriate and development land use. In tandem with the gazetting of water catchment areas, management of these areas needs to be improved in terms of surveillance, enforcement and conservation.

2. Management of river reserves and development along river corridors

River reserves play an important role as a buffer between the river and the surrounding land besides controlling the flow of surface water and mitigating river pollution. Downstream areas of major river reserves should be protected and managed sustainably. The minimum provisions for river reserves in the Drainage and Irrigation Department's guidelines should be adhered to, and any development of the river reserve should be curtailed. The State Structure Plan, Local Plan and Special Area Plan at the local level must serve as control documents.

Rivers also have an amenity value for people living along their banks, mainly as a corridor connecting open and green spaces. Riparian corridors along the river have potential as recreation areas. River reserves need to be gazetted under Section 62 of the National Land Code and identified in the Local Plan.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Federal Territory of Labuan</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th rowspan="3">Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Natural Resources and Environment
• Ministry of Agriculture and Agro-based Industry
• State Governments</td><td rowspan="2">• Sabah Ministry of Infrastructure Development
• Sabah Department of Irrigation and Drainage
• Sabah Forestry Department</td></tr>
<tr><th>Implementing Agency</th><td rowspan="2">• Town and Country Planning Department of Peninsular Malaysia
• Department of Environment Malaysia
• Department of Survey and Mapping Malaysia
• State Water Regulatory Bodies
• State Water Supply Authorities
• Land and Mines Offices
• Land and District Offices
• Local Authorities</td></tr>
<tr><td>• Forestry Department Peninsular Malaysia
• Department of Irrigation and Drainage Malaysia</td></tr>
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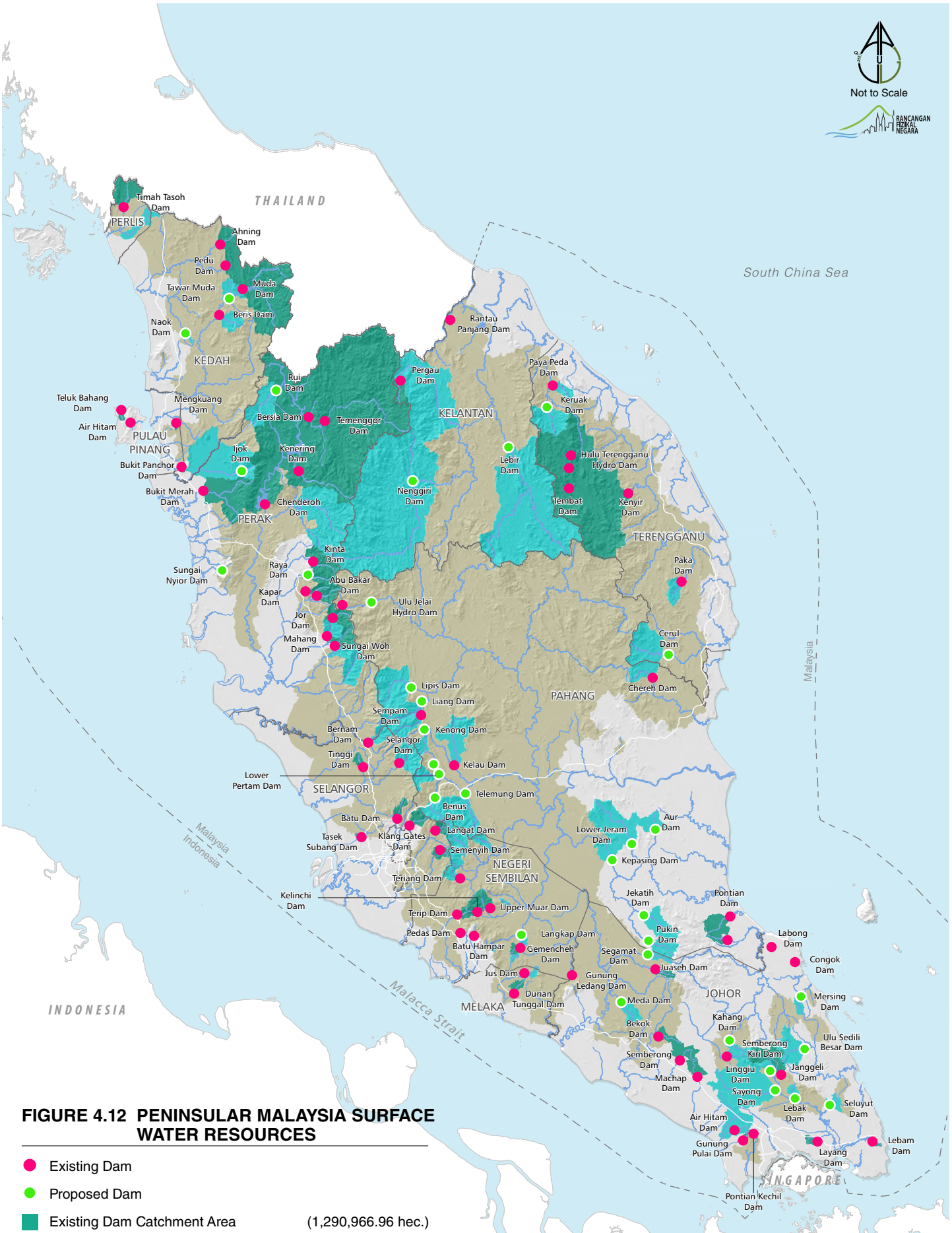


FIGURE 4.12 PENINSULAR MALAYSIA SURFACE WATER RESOURCES

Existing Dam	
Proposed Dam	
Existing Dam Catchment Area	(1,290,966.96 hec.)
Propsoed Dam Catchment Area	(1,669,766.46 hec.)
Water Intake Catchment Area	(6,030,169.42 hec.)
River	

Source: 1. National Water Resource Study (2000-2050)
2. Third National Physical Plan (NPP-3), 2015

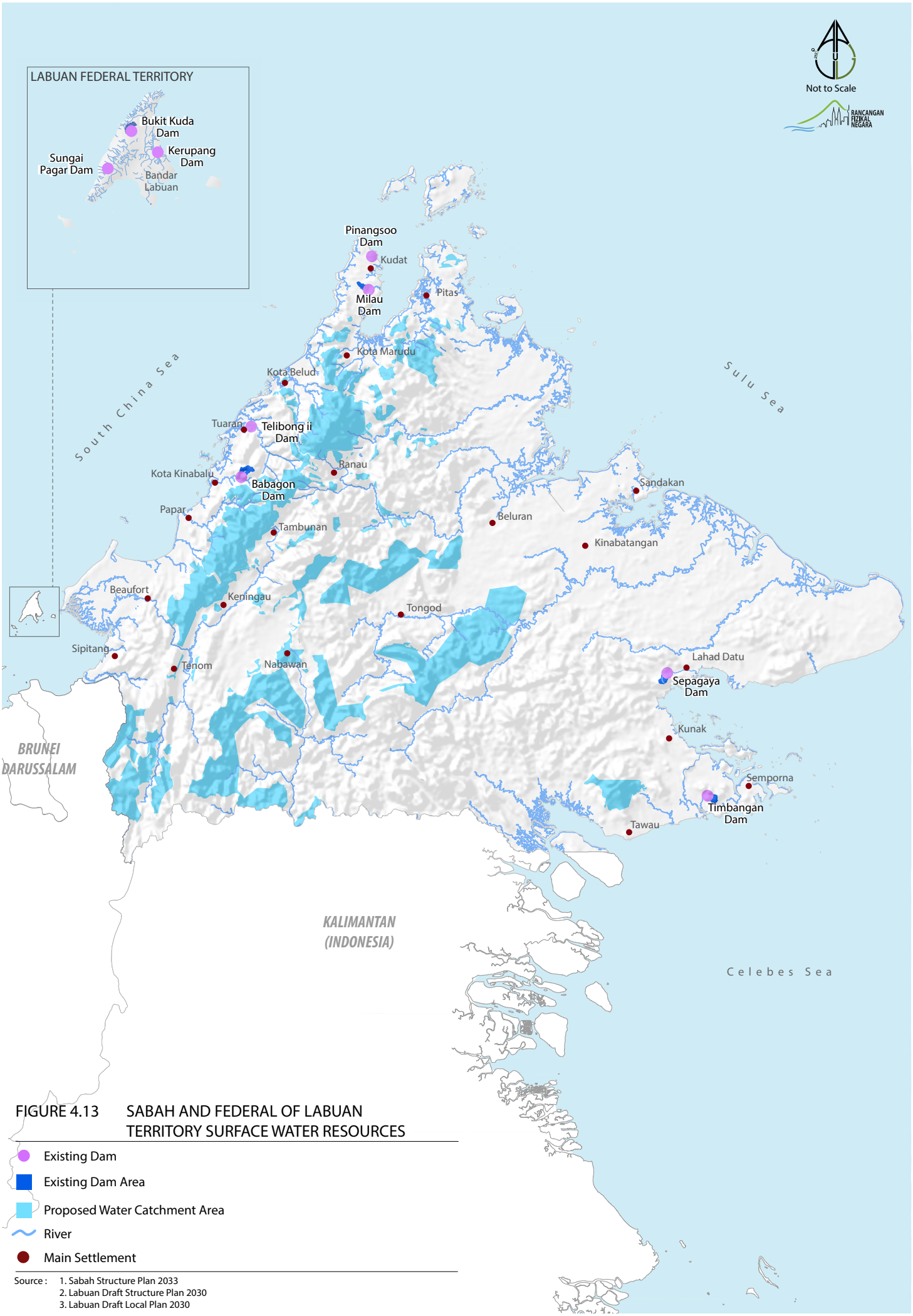


FIGURE 4.13 SABAH AND FEDERAL OF LABUAN TERRITORY SURFACE WATER RESOURCES

- Existing Dam
- Existing Dam Area
- Proposed Water Catchment Area
- River
- Main Settlement

Source :
1. Sabah Structure Plan 2033
2. Labuan Draft Structure Plan 2030
3. Labuan Draft Local Plan 2030

Box 4.7 Example of River Management

Management of Kallang River, Singapore

The Kallang River-Bishan Park ABC Waters Project is a collaboration between Singapore's water agency (PUB) and the Parks Board of Singapore. The project uses a holistic and sustainable approach by linking the river and park.

One of the main features of the redevelopment of this area is the conversion of the existing concrete wall to a more natural riverbank with a bio-engineering approach that combines a variety of plants and a base layer.

The Kallang River then flows to Bishan Park where visitors can enjoy a clean river. The river is also designed to function like a floodplain that can store rain water during the rainy season.

Source: PUB (Singapore's National Water Agency)

3. Strengthening Integrated River Basin Management and Preparing a River Basin Master Plan

In Integrated River Basin Management (IRBM), the objectives of conservation, management and development of water, land and other resources are aligned to ensure that the economic and social benefits obtained do not affect the river basin system. IRBM plans should be prepared for all major river basins in Malaysia to strengthen the basin management system by coordinating the work of the relevant government agencies. IRBM is a component of Integrated Water Resources Management (IWRM), which emphasises management of both water demand and water resources.

River basin management involves the planning, implementation and gazettement of areas straddling mukims, districts, Local or State Authorities, necessitating the sharing of responsibilities. Several river basins in fact straddle two states. A River Basin Master Plan should be prepared especially for critical river basins in states that face water supply issues and flooding.

Spatial and physical planning at the State Structure Plan and Local Plan levels must emphasise on integrated river basin planning. Analysis of land use in river basins should be integrated within the scope of the State Structure Plan and Local Plan.

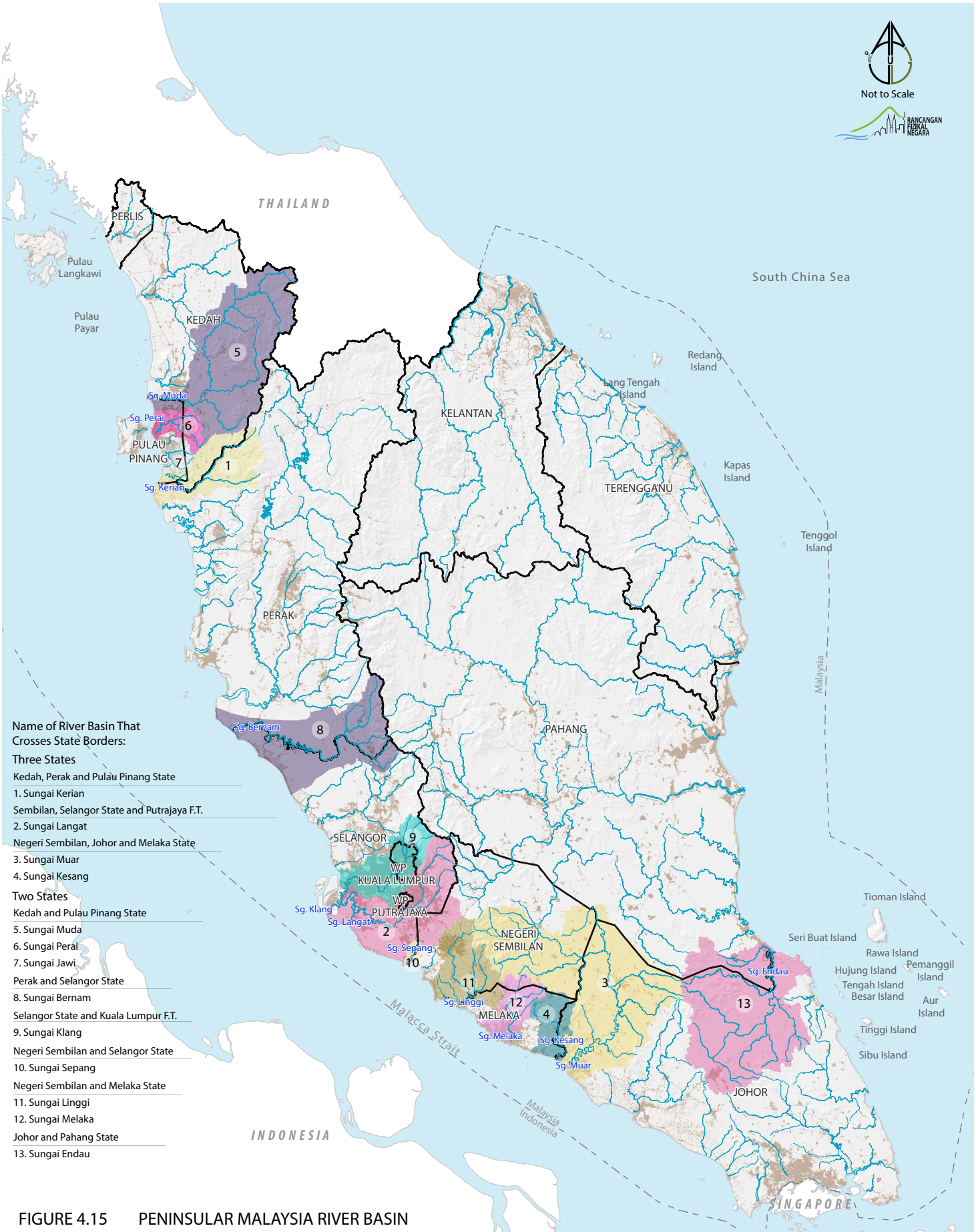
Figure 4.14 PENINSULAR MALAYSIA MAIN RIVER BASIN AREA

River Basin

River

State Border

Source : 1. Department of Town and Country Planning Peninsular Malaysia, 2014
2. Third National Physical Plan (NPP-3), 2015



Name of River Basin That Crosses State Borders:

Three States

Kedah, Perak and Pulau Pinang State

1. Sungai Kerian

Sembilan, Selangor State and Putrajaya F.T.

2. Sungai Langat

Negeri Sembilan, Johor and Melaka State

3. Sungai Muar
4. Sungai Kesang

Two States

Kedah and Pulau Pinang State

5. Sungai Muda
6. Sungai Perai
7. Sungai Jawi

Perak and Selangor State

8. Sungai Bernam

Selangor State and Kuala Lumpur F.T.

9. Sungai Klang

Negeri Sembilan and Selangor State

10. Sungai Sepang

Negeri Sembilan and Melaka State

11. Sungai Linggi
12. Sungai Melaka

Johor and Pahang State

13. Sungai Endau

FIGURE 4.15 PENINSULAR MALAYSIA RIVER BASIN THAT CROSSES STATE BORDERS

River Basin

River

State Border

Existing Built Up Area

Source : 1. Department of Town and Country Planning Peninsular Malaysia, 2014
2. Third National Physical Plan (NPP-3), 2015

Action SR1.3B
Developing groundwater resources

Groundwater resources offer an important alternative water supply for the long term and could help address current issues of water shortage. Groundwater still accounts for less than 3% of the country's water supply despite its high potential as an alternative water supply. In Kelantan, groundwater resources play an important role, accounting for 70% of the public water supply.

1. Mapping of groundwater resources

The National Water Resources Study 2000-2050 estimates the country's groundwater resources at up to 5,000 billion cubic metres. Areas with high groundwater potential should be identified and mapped to encourage the systematic and continuous exploration of groundwater. This requires the development of a database comprising of hydrogeological maps to enable efficient abstraction of groundwater.

2. Management of groundwater resources

Abstraction of groundwater requires careful planning and management. So far, only one groundwater resources management plan has been implemented, namely for the Sungai Langat river basin in Selangor. A management plan must be established for areas identified as having high aquifer potential. The State Structure Plan and Local Plan should identify the water intake catchment area and the recharge zone for ESA Level 3, which requires special land use management. The type and level of development should be strictly controlled depending on the development constraints.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Natural Resources and Environment • State Governments	• Department of Environment Malaysia • State water supply authorities • National Hydraulic Research Institute of Malaysia • Town and Country Planning Department of Peninsular Malaysia • Local Authorities	• Sabah Ministry of Infrastructure Development • Sabah Water Department
Implementing Agency		
• Mineral and Geoscience Department Malaysia		

Groundwater abstraction activities

Source: www.vaws.com.my

Groundwater pumping station and storage tank

Source: www.kibaran.com

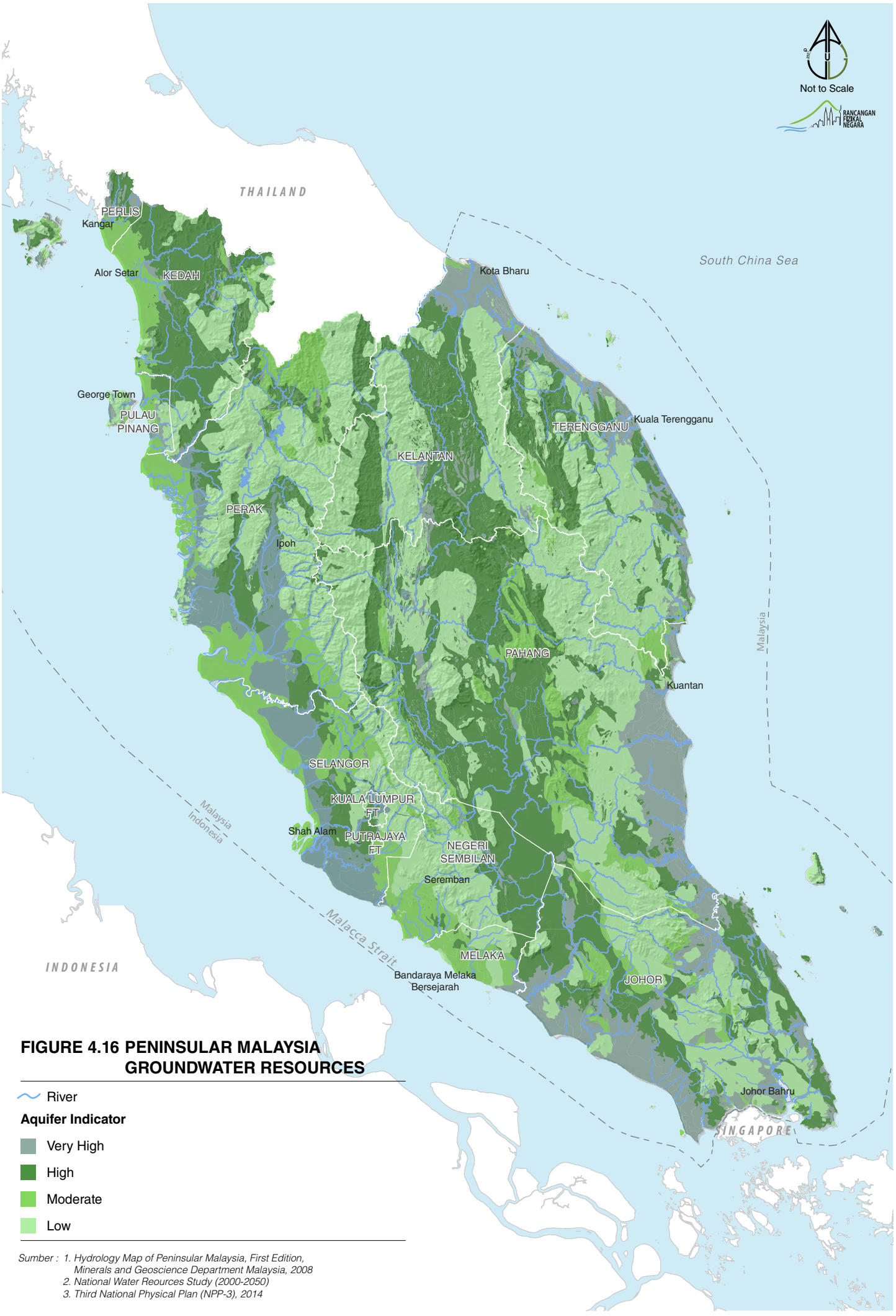


FIGURE 4.16 PENINSULAR MALAYSIA GROUNDWATER RESOURCES

River

Aquifer Indicator

- Very High
- High
- Moderate
- Low

Sumber : 1. Hydrology Map of Peninsular Malaysia, First Edition, Minerals and Geoscience Department Malaysia, 2008
2. National Water Reources Study (2000-2050)
3. Third National Physical Plan (NPP-3), 2014

SR1.4: Managing Mineral Resource Exploration

Malaysia has rich reserves of metallic minerals such as bauxite, iron ore, gold, tin and non-metallic minerals such as coal, limestone, feldspar, kaolin, silica and aggregates. These mineral resources are the raw materials for the mineral-based, energy and housing sectors, among others. However, mineral resources are not renewable and should be sustainably exploited. Mining of mineral resources can bring adverse effects on the environment and residents near the mining areas, but these effects can be minimised through careful and orderly planning, management and operation of mining activities.

Action SR1.4A

Taking mineral resources into account in land use planning

As mineral resources are non-renewable natural resources, their distribution should be identified in greater detail in order to avoid a potential mineral depletion and their exploitation must be effectively controlled through land use planning and development.

1. **Promoting mapping of nation's mineral resources**
   Existing information on the distribution of the country's mineral reserves is still incomplete, and exploration and mapping of mineral resources should be expanded to complement the national mineral inventory database in the form of a Geographic Information System (GIS). Accurate and comprehensive GIS information promotes sustainable development.

2. **Prioritising mineral production in land use planning**
   Any land use planning should take into account the mineral reserves in the area. Mineral production should be given priority before other development in order to prevent mineral infertility. Any request for mineral production needs to go through the State Mineral Resources Committee before being submitted for approval by the State Authority. This can avoid land use conflicts in the future as well as the negative effects that may arise as a result of mining activities. Other factors include the social, economic and environmental impacts should be taken into account when assessing areas with high mineral potential.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Federal Territory of Labuan</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th>Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Natural Resources and Environment

Implementing Agency
• State Governments
• Mineral and Geoscience Department Malaysia</td><td>• Department of Survey and Mapping Malaysia
• Town and Country Planning Department of Peninsular Malaysia
• Local Authorities</td><td>• Office of Natural Resources of Sabah Chief Minister's Department
• Sabah Ministry of Tourism, Culture and Environment
• Department of Environment
• Mineral and Geoscience Department Malaysia, Sabah</td></tr>
</table>

Action SR1.4B
Developing sustainable exploitation of mineral resources

Mining of mineral resources could cause environmental pollution and threaten public health if the operations are not planned, implemented and monitored in accordance with the rules and guidelines.

1. **Adhering to ESA framework**

   Guidelines for Planning and Development of Environmentally Sensitive Areas (ESAs) should be used as a guide for mining activities. According to the ESA guidelines, new mining and quarrying activities are not permitted except in Level 3 ESAs and the activities are controlled in accordance with the guidelines provided. However, for ongoing activities in Level 1 and 2 ESAs, the operators should adopt Best Available Technology Not Entailing Excessive Costs (BATNEEC) mining practices to minimise the detrimental effects on the environment. Close monitoring should be carried out so that all environmental pollution and disaster mitigation measures are properly executed.

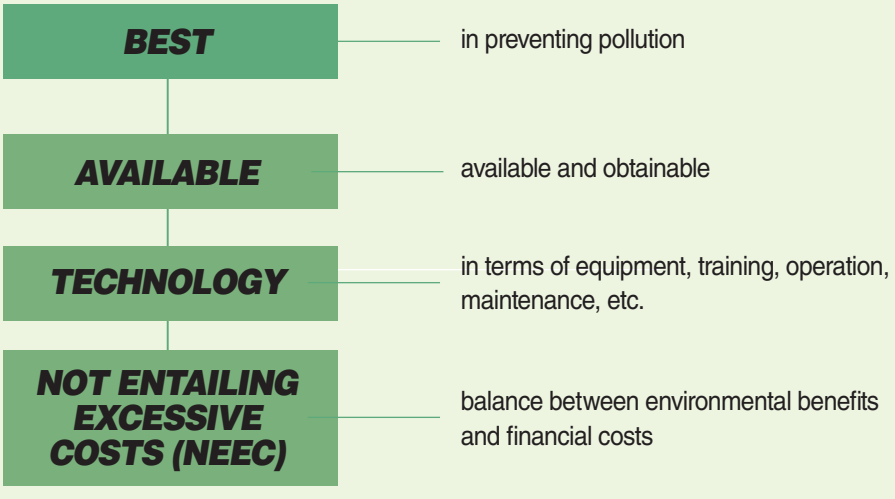
2. **Carrying out of evaluation studies**

   Under the Environmental Quality (Prescribed Activities) (Assessment of Environmental Impact) 2015, mining activities specified under Activity 8 in the First and Second Schedules are subject to an Environmental Impact Assessment Report (EIA). For Sabah, under the Environmental Protection Enactment 2002, the EIA report is required for mining activities as defined under Activity 7 of the Second Schedule of the Environmental Protection (Prescribed Activities) Order 2005.

   State governments are encouraged to require an Environmental Management Plan (EMP) for every mining application activities that are not subjected to an EIA report. Preparation of the EIA report should also be in accordance of the Environmental Impact Assessment (EIA) Guidelines in Peninsular Malaysia and Sabah. For any approved mining activities, mine operators must adopt BATNEEC practices.

Box 4.8 *Best Available Technology Not Entailing Excessive Costs (BATNEEC)*

BATNEEC practices constitute a regulatory principle that is often used in the control of environmental risks.



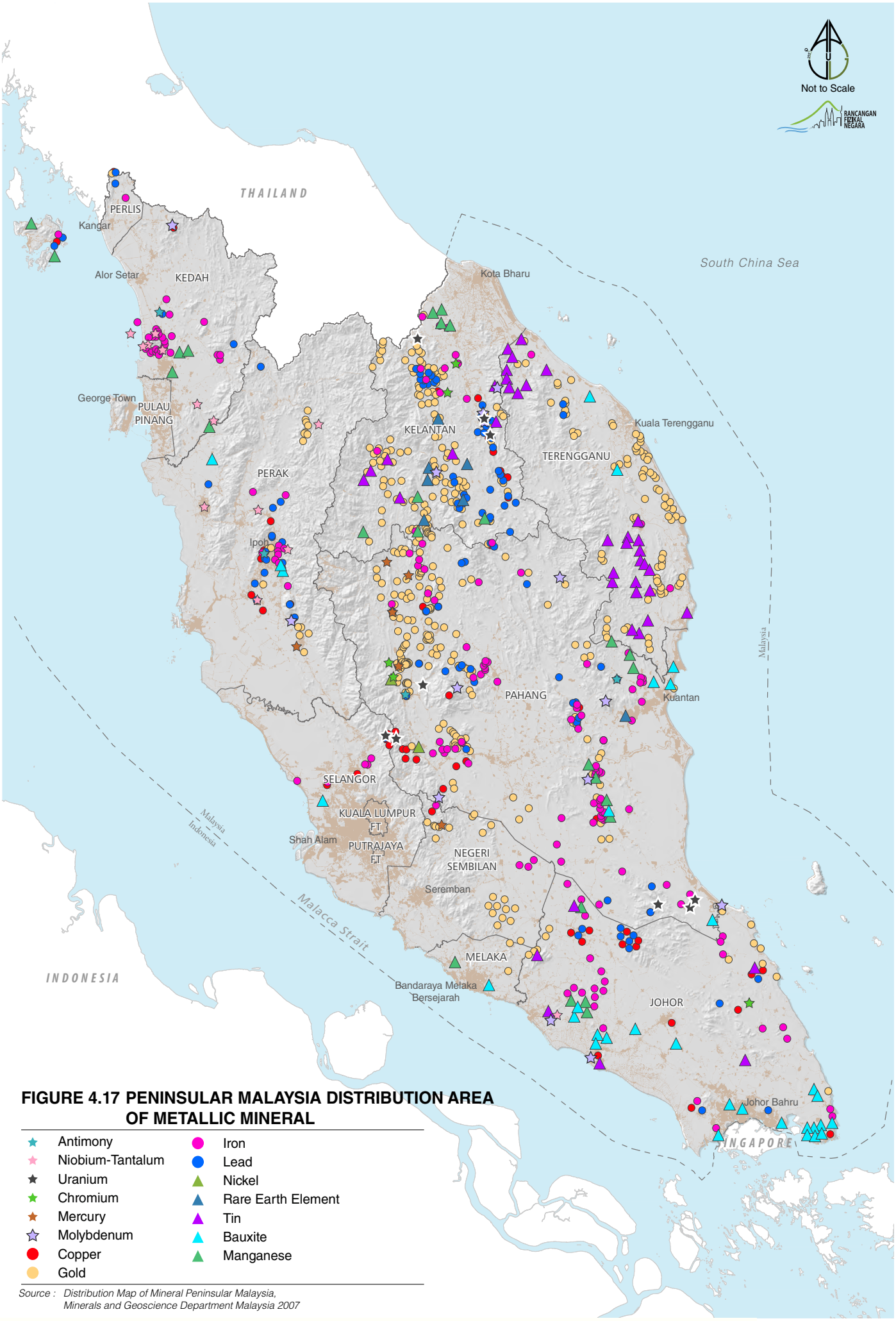


FIGURE 4.17 PENINSULAR MALAYSIA DISTRIBUTION AREA OF METALLIC MINERAL

- Antimony
- Niobium-Tantalum
- Uranium
- Chromium
- Mercury
- Molybdenum
- Copper
- Gold
- Iron
- Lead
- Nickel
- Rare Earth Element
- Tin
- Bauxite
- Manganese

Source : Distribution Map of Mineral Peninsular Malaysia, Minerals and Geoscience Department Malaysia 2007

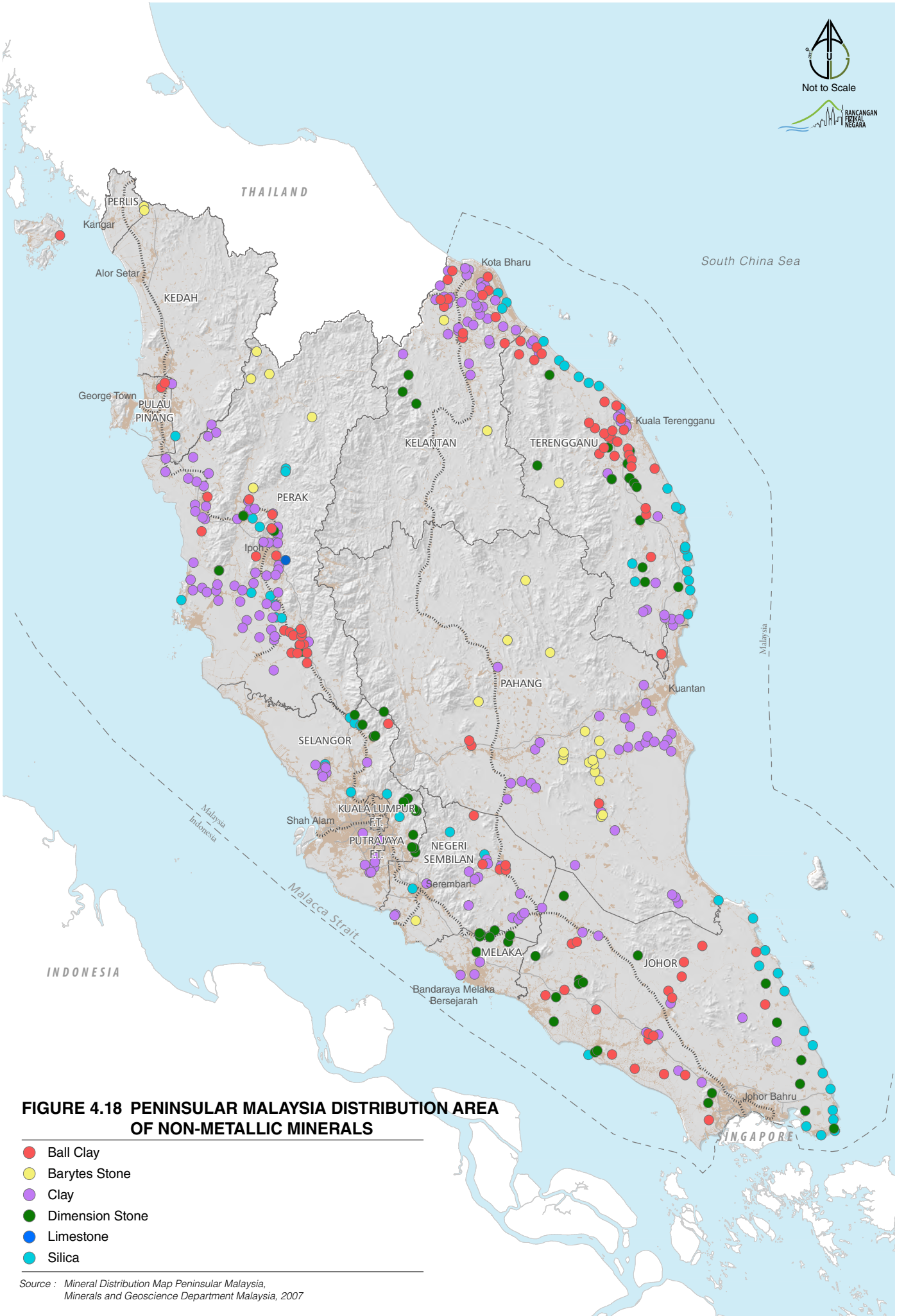


FIGURE 4.18 PENINSULAR MALAYSIA DISTRIBUTION AREA OF NON-METALLIC MINERALS

- Ball Clay
- Barytes Stone
- Clay
- Dimension Stone
- Limestone
- Silica

Source : Mineral Distribution Map Peninsular Malaysia, Minerals and Geoscience Department Malaysia, 2007

3. Enforcing the Mineral Development Act

The Mineral Development Act 1994 (Act 525) regulates exploration and mining of minerals and mineral ores and other related matters. The Act authorises the Mineral and Geoscience Department to regulate the operations of mineral mining, environmental care and related issues.

All mineral mining activities must comply with the approved mining operation scheme to ensure the environmental safety of the local population. For Sabah, regulation and management of mining activities is governed under the Mineral Enactment 1999, under which development and mining operations can be stopped in the event of violation.

For quarrying, the Quarrying Rules under the National Land Code 1965 are applicable to ensure quarrying activities are carried out in a sustainable manner. As of 2016, six states have adopted and enforced the Quarrying Rules namely Perak, Kelantan, Selangor, Terengganu, Pahang and Sabah. Other states should also adopt and enforce these Rules in order to control quarrying operations and promote environmental

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Natural Resources and Environment	• Department of Survey and Mapping Malaysia • Town and Country Planning Department of Peninsular Malaysia • Land and Mineral Offices • Land and District Offices • Local Authorities	• Sabah Chief Minister's Department (Office of Natural Resources) • Sabah Ministry of Tourism, Culture and Environment • Department of Environment • Mineral and Geoscience Department Malaysia
Implementing Agency		
• State Governments • Mineral and Geoscience Department Malaysia		

Action SR1.4C

Conserving and redeveloping former mining areas

Reclaimed former mining areas have the potential to be reused for other purposes including tourism, development, agriculture, recreational lakes, water catchments and flood mitigation. Conservation and redevelopment of former mining areas approved under the Mining Control Scheme should be adapted to future land use planning.

Before a former mining area is developed, a feasibility study must be conducted to ensure that the proposed development does not bring disaster risks. For former mining areas that are developed as water catchment or recreational areas, the water in the vicinity of the mines should be safe and free from hazardous substances such as heavy metals.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Natural Resources and Environment	• Mineral and Geoscience Department • Department of Environment Malaysia • Town and Country Planning Department Peninsular Malaysia • Local Authorities • State water supply authorities	• Sabah Ministry of Tourism, Culture and Environment • Department of Environment • Sabah Chief Minister's Department (Office of Natural Reso
Implementing Agency		
• State Governments		

Box 4.9 Example of Redevelopment of Former Mining Area

1. Mines Resort City, Seri Kembangan, Selangor

This former tin mine was the largest tin mine in the world, covering 526 hectares (1,300 acres) including the lake area, and has been developed as the Mines Resort City mixed-use development comprising offices, shopping malls, hotels, residential areas and recreational areas.

2. Lake Garden of Kuala Lumpur

Lake Garden, a reclaimed former tin mine, is now one of the better-known recreational parks in Kuala Lumpur. It offers a jogging track, canoeing and horse riding facilities as well as peaceful garden views.

3. Sunway City, Selangor

Sunway City is another example of a mixed-use development in a former mining area. Sunway Lagoon and Sunway Pyramid opened in 1993 and 1997 as amusement theme park and a shopping centre respectively, have become notable attractions for local and foreign visitors. The area includes a business district, offices, hotels, theme parks, colleges, university and private hospital.

Source: Planning Guidelines for the Identification of Brownfield Area Development, Town and Country Planning Department of Peninsular Malaysia

SR1.5: Permament Food Production Park (TKPM)

Food security in the NPP-3 is focusing on the preparation and preservation of agricultural areas for rice, fruit and vegetables, livestock and fisheries, in accordance with the 11MP's focus on enhancing the growth and sustainability of this sector. Rapid industrialisation and urbanisation have direct implications on agricultural land in terms of increased competition from land use and prices that give higher returns for non-agricultural use. Accordingly, there is a need to identify special areas for agricultural activities especially for food security purposes which will be maintained to meet the needs of the growing population.

The NPP-3 maintains the existing policies related to rice bowls and identifies strategies to develop areas of high potential for the agro-food sector as permanent food production park (TKPM) in each state. In addition, the implementation of R&D, integration of crops and supporting infrastructure will be emphasised to improve the productivity and sustainability of the country's agro-food sector. Proposed actions identified are intended to support the national food security agenda.

Action SR1.5A

Preserving the rice cultivation area in the 12 main granary areas

Rice is a staple food and a strategic crop in Malaysia. The self-sufficiency level (SSL) for rice stands at 70%, with imports making up for the shortfall. The country imports between 1.0 million to 1.3 million metric tonnes a year. In the 2000-2012 period the country lost 4,634 hectares of granary areas (or 2.25% of the total area) due to changes in land use to industrial, residential and other agricultural activities. Measures to preserve the physical of granary areas includes:

1. Gazettement under the National Land Code

There are many constraints in carrying out efforts to preserve land for rice cultivation as most rice-growing land is privately owned. So far, the power to gazette granary areas is through Section 64 of the National Land Code 1965. The National Land Code empowers the State Authority to declare any area of land in the state to be zoned for any category of land use. Once gazetted, any land zoned by the State Authority will be imposed certain conditions. But so far, no land in any granary areas has been gazetted under the National Land Code. Therefore it is important for the relevant State Government to gazette land in granary areas under the National Land Code. It is recommended that this gazettement is supported by the National Climate Change Trust Fund and complemented by the Transfer of Development Rights mechanism, where the development rights for the land involved are transferred to another area or piece of land within the development area (see Chapter 7).

2. Enforcing the Irrigation Act 1953 (Amendment 1989)

Another Act which can be adopted for gazetting such areas is the Irrigation Act 1953 (Amendment 1989). Irrigation schemes are irrigation projects that have been completed and commissioned and recognised by the authorities as irrigation areas. Each scheme has a predetermined boundary. All the major irrigation schemes have been gazetted as irrigation areas under this Act. This Act should be enforced by the State Government to ensure land in granary areas is not converted to other land use types, otherwise replacement

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Federal Territory of Labuan</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th rowspan="3">Support Agency</th><th rowspan="3">Support Agency</th></tr>
<tr><td>• Ministry of Agriculture and Agro-based Industry
• Ministry of Natural Resources and Environment
• State Governments</td></tr>
<tr><th>Implementing Agency</th></tr>
<tr><td>• Department of Agriculture Malaysia
• Department of Irrigation and Drainage Malaysia
• Land and Mines Office</td><td>• State Economic Planning Units
• Town and Country Planning Department of Peninsular Malaysia
• Muda Agricultural Development Authority (MADA),
• Kemubu Agricultural Development Authority (KADA)
• All development areas
• Integrated Agriculture (IADA) areas</td><td>• Sabah Ministry of Agriculture and Food Industry
• Sabah Department of Agriculture
• Sabah Department of Irrigation and Drainage</td></tr>
</table>

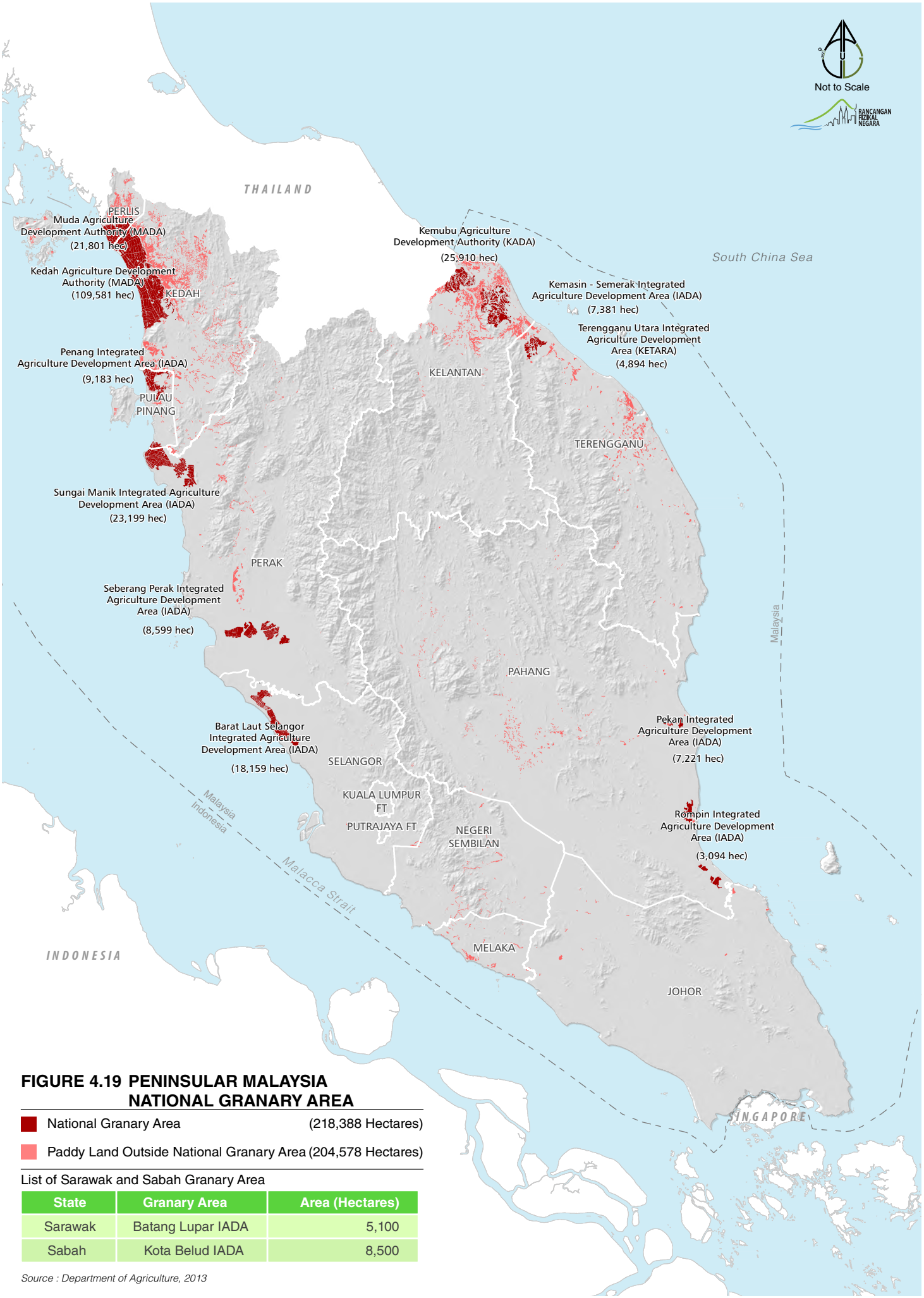


FIGURE 4.19 PENINSULAR MALAYSIA NATIONAL GRANARY AREA

National Granary Area (218,388 Hectares)

Paddy Land Outside National Granary Area (204,578 Hectares)

List of Sarawak and Sabah Granary Area

State	Granary Area	Area (Hectares)
Sarawak	Batang Lupar IADA	5,100
Sabah	Kota Belud IADA	8,500

Source : Department of Agriculture, 2013

Action SR1.5B

Raising self-sufficiency level in food commodities (rice, fruits, vegetables, fisheries and livestock)

The Self-Sufficiency Level (SSL) for food commodities as prescribed under the National Agro-Food Policy is as follows:

1. **Granary areas and rice-growing areas outside granary areas**

   To achieve a minimum self-sufficiency level of 70% until the year 2040, the following conditions must be met:

   a. Retention of at least 215,000 hectares in the 12 granary areas. Crop intensity reaches 200% through improvements in irrigation infrastructure, with irrigation intensity in granary areas rising from 30 metres /hectare to 50 metres/hectare.

   b. Achieving 6 tonnes/hectare rice production in granary areas by 2040 through the use of technology, better water management and consolidating rice fields into mini-estates.

   c. Preserving and upgrading 130,000 hectares of rice-growing area outside granary areas under DID's double cropping scheme (two crops a year).

Table 4.6 National Self-sufficiency Level in Food Commodities

	2013 (%)	2020 (%)
CROP		
• Rice	71.4	70.0
• Fruits	57.8	76.3
• Vegetables	58.6	67.6
LIVESTOCK		
• Cattle	28.6	50.0
• Goats	10.6	30.9
• Chicken	127.9	131.6
FISH		
• Aquaculture	10.0	41.0

Source: National Agro-Food Policy 2011-2020

2. **Permanent Food Production Parks (PFPPs)**

   To achieve self-sufficiency level (SSL) targets for vegetables and fruits, the production of these crops could be enhanced through the following strategies:

   a. An increase of 80,000 hectares in vegetable and fruit growing areas by 2040 to meet the country's growing needs through the creation of new PFPP areas and integrating the crops in oil palm or rubber plantations; and

   b. An increase in productivity through the use of technology and mini-estate management.

   The PFPP programme is one of the cluster development strategies to promote the implementation of large-scale commercial and high-technology agricultural projects, involving the entire chain from production to marketing. State Governments' commitment in identifying areas suitable for PFPPs is necessary to enable the achievement of the PFPP target area by 2040. In addition, all PFPP participants should adopt good agricultural practices (MyGAP).

Implementation and monitoring responsibilities

Peninsular Malaysia and Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Agriculture and Agro-based Industry • State Governments	• State Economic Planning Units • Department of Irrigation and Drainage Malaysia • Farmers Organisation Authority • MADA • KADA • All IADAs • FELDA • Regional Corridor authorities	• Sabah Ministry of Agriculture and Food Industry • Sabah Department of Agriculture
Implementing Agency		
• Department of Agriculture Malaysia • Department of Fisheries Malaysia • Department of Veterinary Services		

3. Aquaculture Industrial Zones (AIZs)

Total fish demand is expected to increase from 1.3 million metric tonnes in 2010 to 2.2 million metric tonnes in 2040 with an annual growth rate of 2.3%. Marine fish production is expected to decrease and this shortfall should be met through increased aquaculture production.

To achieve the self-sufficiency level (SSL) goal for fish aquaculture, production should be increased through an additional 74,000 hectares of Aquaculture Industrial Zone (AIZ) by the year 2040. The AIZ programme entails zoning suitable land and waters for commercial aquaculture.

So far an area of 31,905 hectares has been zoned as AIZs, with the focus in Sabah and Sarawak as Peninsular Malaysia no longer has new areas suitable for aquaculture. Sabah has identified areas for AIZ in Sandakan, Lahad Datu, Tawau, Beaufort and Kuala Penyu. Of the 63,000 hectares of land suitable for aquaculture, 30,000 hectares have been gazetted for aquaculture development.

4. Livestock grazing areas

Demand for meat is expected to increase from 1.4 million metric tonnes in 2010 to 1.8 million metric tonnes in 2020, with a growth of 2.4% per annum. The livestock industry, especially ruminant breeding, is still small and has the potential to enhance the nation's food security and reduce meat imports.

Among the issues and challenges faced in the development of this industry are the lack of quality breeds, high feed prices and a lack of expertise and manpower. Currently, only 1.5% of agricultural land in Peninsular Malaysia is used for livestock, showing the limited land area for livestock development. It is therefore important to zone existing areas for livestock development, as the self-sufficiency level for beef is projected to grow to 50% in 2040.

Table 4.7 Projected Land Requirements for Ruminants until Year 2040

	2010	2020	2030	2040
Population (million)	28.59	32.44	35.97	38.56
Consumption per capita (kg)	5.6	7.0	10	12
Overall meat demand ('000 tonnes)	160.1	227.1	359.7	468.72
Self-sufficiency level target (%)	29	40	45	50
Total domestic production to meet demand ('000 tonnes)	46.43	90.84	161.86	231.36
Number of cattle required				660,448
Stocking rate (cattle/hectare/year)				25
Total area required for intensive farming (hectares)				**26,000**

Source: National Physical Plan-3, 2015

To achieve minimum self-sufficiency level by year 2040, the following goals must be achieved:

01 Granary areas and rice-growing areas outside granary areas

a. Maintain at least **215,000 hectares** in the **12** granary areas

b. Achieve **200% plantation intensity** through improvements in irrigation infrastructure in rice bowls

c. Achieve **6 tonnes / hectares** rice yield in granary areas by **2040**

d. Preserve and upgrade **130,000 hectares** outside granary areas under DID scheme for two crops a year

x2

02 Permanent Food Production Parks (PFPPs)

Add **80,000 hectares** to PFFP area by **2040** to meet nation's demand for vegetables and fruits

03 Add **74,000 hectares** to Aquaculture Industrial Zone (AIZ) area by **2040**

04 Livestock grazing area

Maintain and improve infrastructure for **22,000 hectares** of livestock area to meet demand for meat by **2040**

A rice field in Sekinchan, Selangor

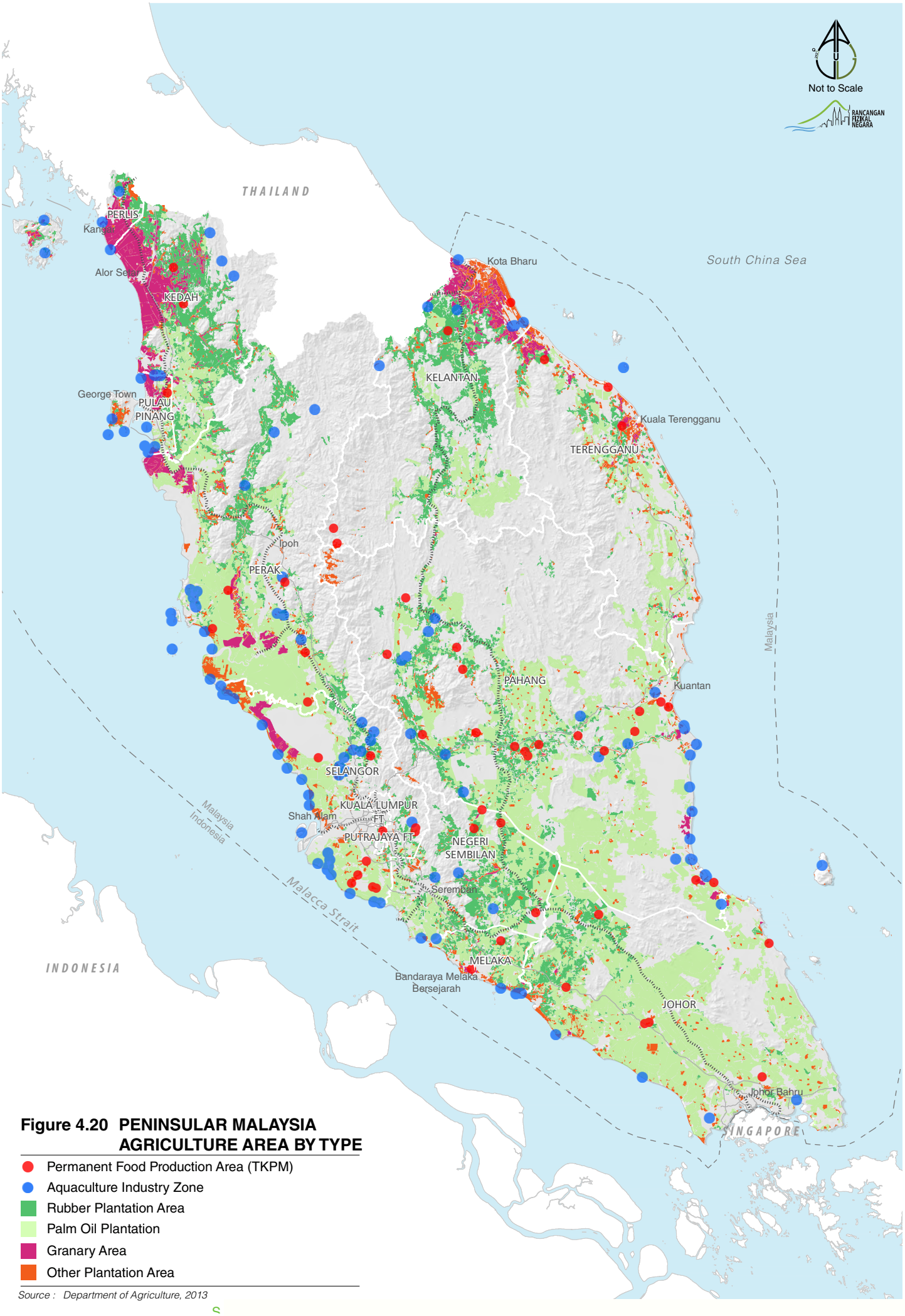


Figure 4.20 PENINSULAR MALAYSIA AGRICULTURE AREA BY TYPE

- Permanent Food Production Area (TKPM)
- Aquaculture Industry Zone
- Rubber Plantation Area
- Palm Oil Plantation
- Granary Area
- Other Plantation Area

Source : Department of Agriculture, 2013

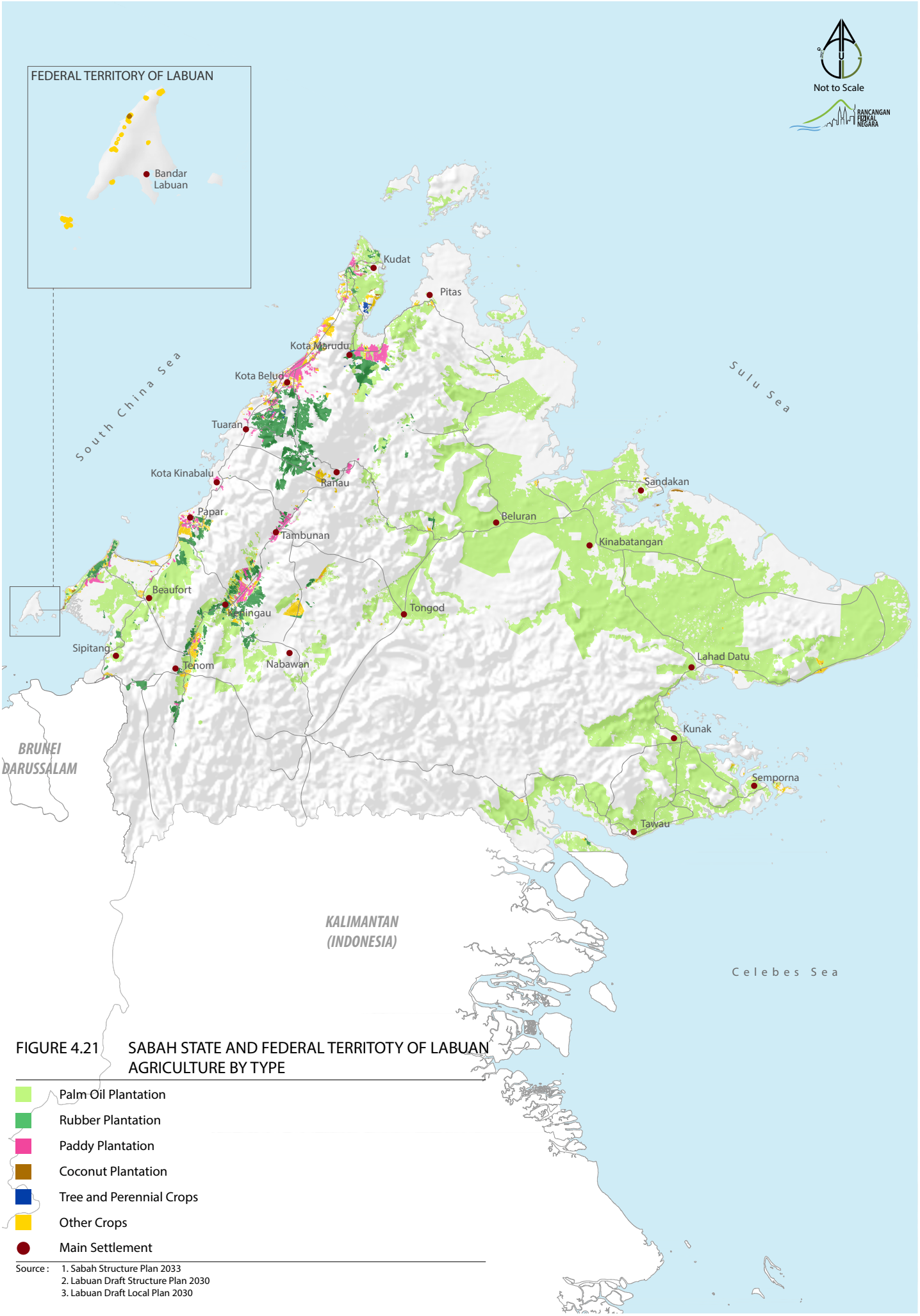


FIGURE 4.21 SABAH STATE AND FEDERAL TERRITOTY OF LABUAN AGRICULTURE BY TYPE

- Palm Oil Plantation
- Rubber Plantation
- Paddy Plantation
- Coconut Plantation
- Tree and Perennial Crops
- Other Crops
- Main Settlement

Source :
1. Sabah Structure Plan 2033
2. Labuan Draft Structure Plan 2030
3. Labuan Draft Local Plan 2030

Action SR1.5C
Developing urban farming

Urban farming is an agricultural activity carried out by local residents who volunteer for this community activity. A minimum size for a community garden is 929 sq. m. (10,000 sq. ft.), although this would depend on the suitability of the site.

Implementing an urban farming involves:

i. Identifying vacant land such as utility reserve land, idle and undeveloped land to be developed as an urban farming area with the permission of the land owner or relevant authority;
ii. Management by an entity such as residents' association, Rukun Tetangga (Neighbourhood Watch) and other groups that involve residents of green neighbourhood; and
iii. Promoting urban farming activities in residential and institutional areas using of recycled materials such as wooden pallets, bottles, drums and so on.

For new neighbourhoods, developers are encouraged to provide urban farming reserves as part of their green neighbourhood coverage and which can be seen as value added to the layout plan.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Labuan Federal Territory</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th>Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Agriculture and Agro-based Industry</td><td rowspan="2">• Town and Country Planning Department of Peninsular Malaysia
• Regional Authorities</td><td rowspan="2">• Sabah Ministry of Agriculture and Food Industry
• Sabah Ministry of Local Government and Housing
• Local Authorities</td></tr>
<tr><th>Implementing Agency</th></tr>
<tr><td>• Department of Agriculture Malaysia
• Local Authorities</td><td></td><td></td></tr>
</table>

Box 4.10 Urban Farming

1. Urban farming in Shah Alam, Selangor

This urban farming program began in September 2014 with briefings and crop management courses given to the Lapan Timur Residents' Association of Section 8, Shah Alam.

Sumber: www.mbsa.gov.my

2. Iskandar Malaysia Urban Farming Development Centre (UFDC)

This programme has two categories – 'farm to eat' for those with limited space, and 'farm to sell' for large-scale agriculture -- with the products sold exclusively to mCoop and Koperasi Pelaburan Bank Muamalat Malaysia (KOPUTRA)

Source: http://www.nst.com.my

SR1.6 : Strengthening the Protection and Conservation of Archaeological and Natural Heritage Sites

Archaeological and natural heritage sites are sites of national importance that preserve high-value historical and natural heritage. Some of the sites have been recognised as National Heritage Sites and Heritage Sites under the National Heritage Act 2005 (Act 645), which gives them protection through research, conservation and preservation efforts. However, some of these sites need special protection from the pressures and impacts of development around them. Their preservation and conservation can enhance their role as a source of national history and identity.

Action SR1.6A

Gazetting National archaeological and natural heritage sites

National archaeological and natural heritage sites that have not been gazetted should be protected through their gazettement and listing on the National Heritage List under the National Heritage Act 2005 (Act 645). For sites located in privately owned land, cooperation among the National Heritage Department, local authorities and landowners is necessary to facilitate the site's preservation. Collaboration with higher education institutions with specialisation in archaeology and natural heritage should be established, in order to promote public awareness of the sites' importance.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Tourism and Culture Malaysia	• Land and District Offices • Department of Survey and Mapping Malaysia • Universities/Institutions of Higher Learning • Local Authoritie	• Sabah Ministry of Tourism, Culture and Environment • Department of Sabah Museum • Sabah Forestry Department
Implementing Agency		
• State Governments • Department of National Heritage		

Excavation at Gua Kelawar, Lenggong, Perak

Source: Department of National Heritage

Action SR1.6B
Providing a Conservation Management Plan

Archaeological and natural heritage sites are sensitive areas that need to be managed accordingly. In addition, development activities in surrounding areas should be controlled so as not to harm archaeological and natural treasures of high importance. Accordingly, a Conservation Management Plan for the heritage sites and also for surrounding areas should be prepared. The management plan should include:

1. Retention, preservation and conservation of heritage sites;
2. Carrying capacity especially for the purposes of excavation, research and tourism;
3. Guidelines for development in surrounding areas including for agricultural activities;
4. Development of tourism products and packages based on the principles of sustainable and responsible tourism as these archaeological and natural heritage sites have high potential as a catalyst for local and district economic development;
5. Management and development incentive mechanism such as adoption of Transfer of Development Rights; and
6. Involvement of the community in the restoration, preservation and conservation as well as in development that promotes the best interests of heritage sites, including the adoption of Community Conserved Indigenous Area (ICCA) approach (Refer Action SR1.1B).

The Conservation Management Plan will then need to be translated as a Special Area Plan (SAP) to enable implementation at state or district level, with a focus on development control.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Tourism and Culture Malaysia • State Governments	• Town and Country Planning Department of Peninsular Malaysia • State Departments of Town and Country Planning • Local Authorities	• Sabah Ministry of Tourism, Culture and Environment • Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Department of Environment • Sabah Parks
Implementing Agency		
• Department of National Heritage		

Archaeological Site at Kota Tampan, Lenggong, Perak

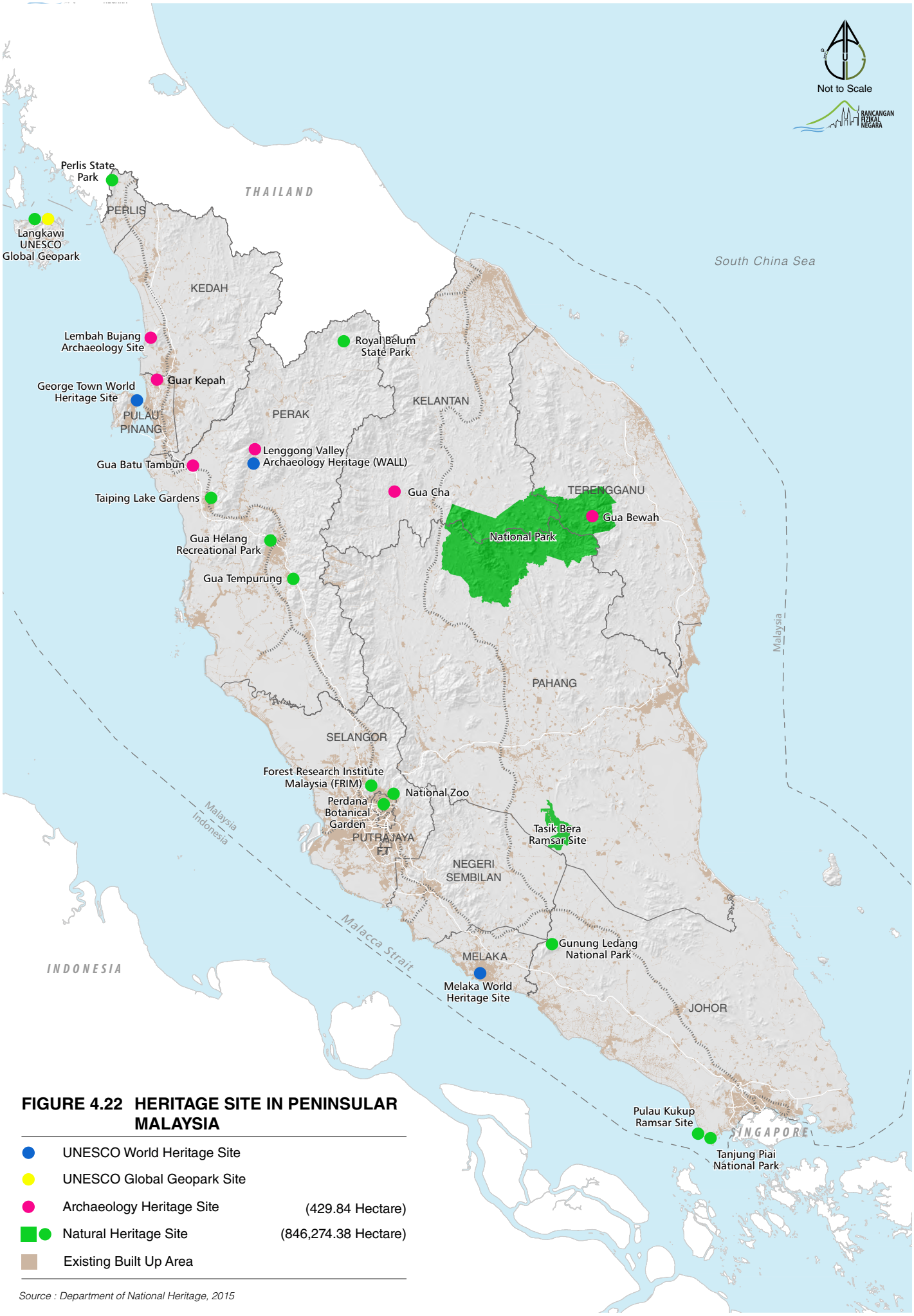


FIGURE 4.22 HERITAGE SITE IN PENINSULAR MALAYSIA

●	UNESCO World Heritage Site	
●	UNESCO Global Geopark Site	
●	Archaeology Heritage Site	(429.84 Hectare)
■ ●	Natural Heritage Site	(846,274.38 Hectare)
■	Existing Built Up Area	

Source : Department of National Heritage, 2015

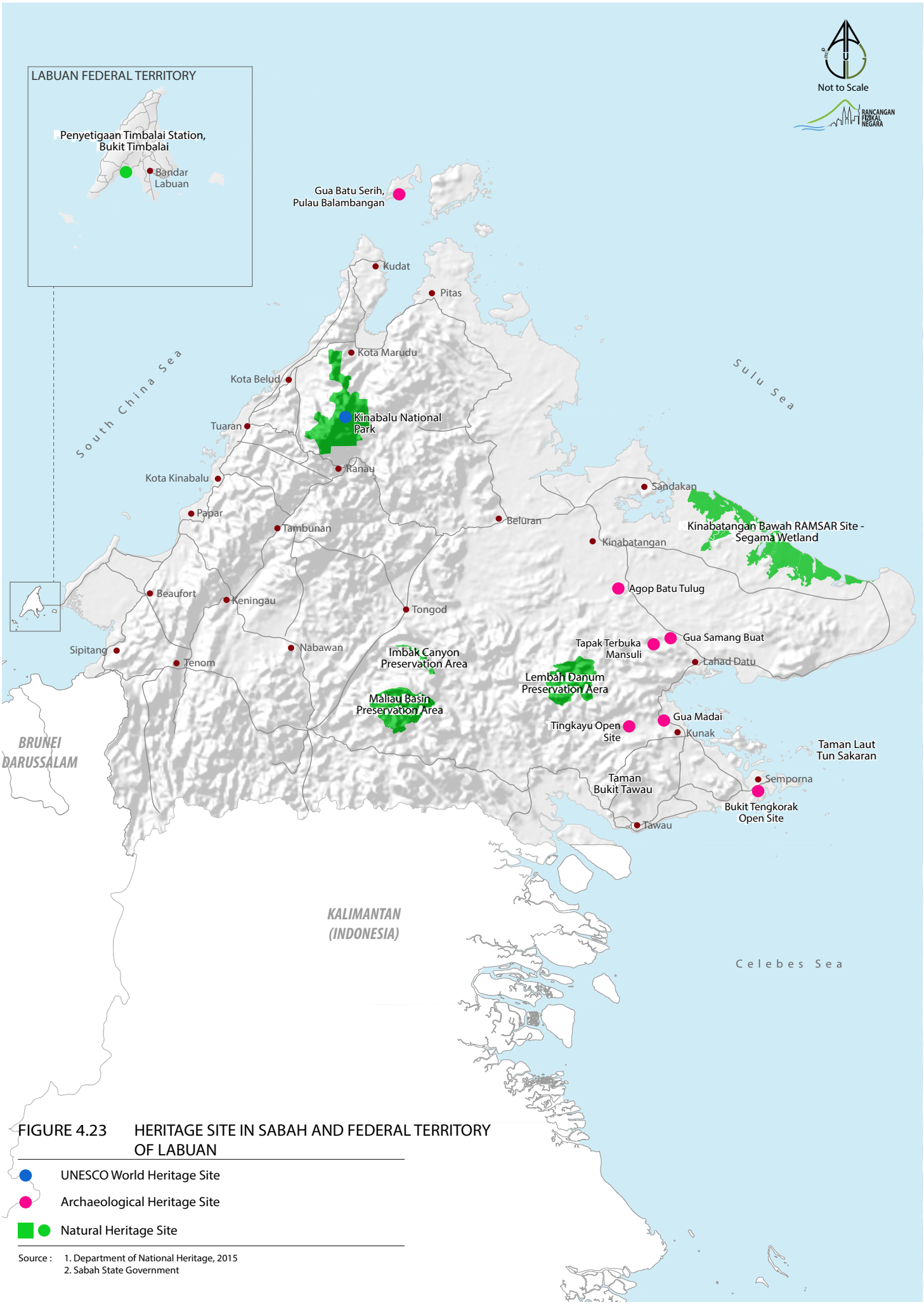


FIGURE 4.23 HERITAGE SITE IN SABAH AND FEDERAL TERRITORY OF LABUAN

- UNESCO World Heritage Site
- Archaeological Heritage Site
- Natural Heritage Site

Source : 1. Department of National Heritage, 2015
2. Sabah State Government

SR2

Holistic Land Use Planning

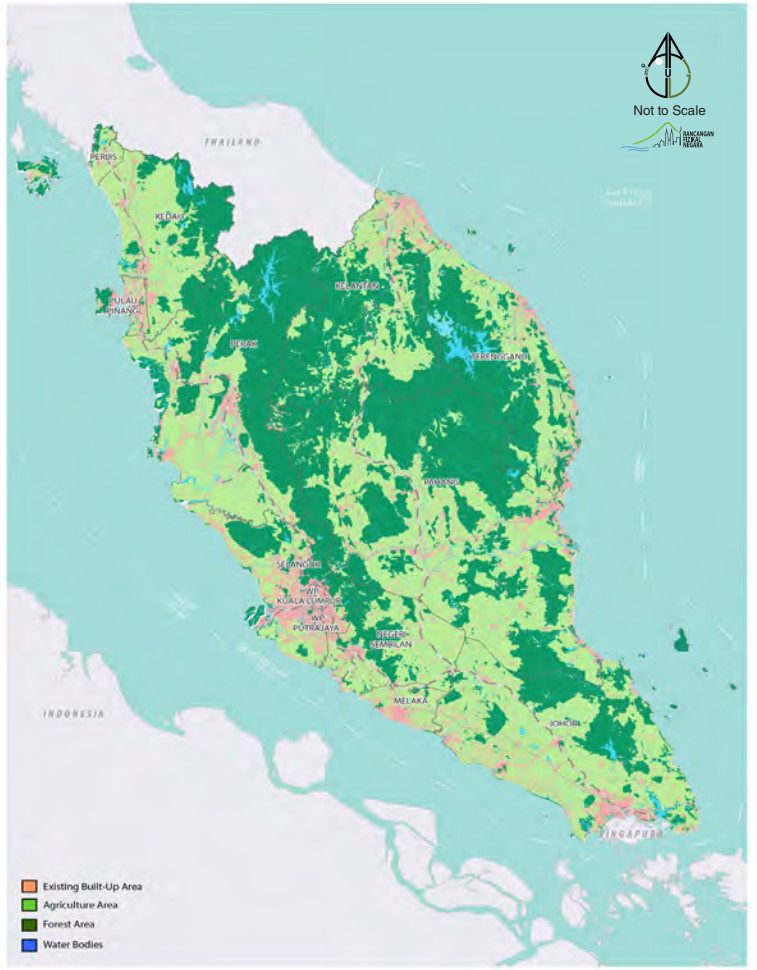
Formulating comprehensive land use planning to promote sustainable and resilient development

The need to balance land use for urban and economic development with social purposes through distribution of land as a source of food and preservation of natural resources requires a balanced and holistic land use strategy. The effects of development in high-risk areas should also be considered to minimise the negative impact on life and property.

Box 4.11 Land Use in Peninsular Malaysia, Sabah and Federal Territory of Labuan, 2014

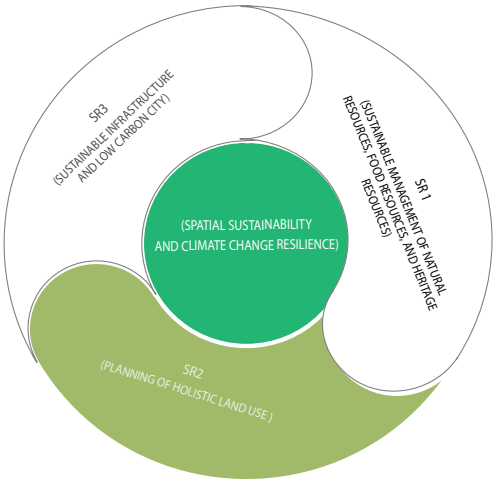
The total built-up area of Peninsular Malaysia, Sabah and FT Labuan is 1,354,468 hectares. For Peninsular Malaysia, the built-up area of 1,174,300 hectares represents almost 9% of the peninsulars land area. The built-up area in Sabah covers 2.32% of the whole state, while in FT Labuan it covers almost 50% of the entire island.

Current Land Use Peninsular Malaysia, 2014



	Peninsular Malaysia	Sabah	WP Labuan
Existing Built-Up Area	**8.91%** 1,174,300 hectare	**2.32%** 175,674 hectare	**47.10%** 4,494 hectare
Agricultural Area	**49.14%** 6,476,900 hectare	**62.66%** 3,120,000 hectare	**5.78%** 547 hectare
Forest Area	**39.35%** 5,187,400 hectare	**27.50%** 2,037,750 hectare	**1.32%** 122 hectare
Water Body	**2.48%** 326,700 hectare	**0.76%** 56,316 hectare	**2.20%** 198 hectare

Land use planning and development should also take into account the need to control development sprawl, with a focus on urban development in the urban fringes. For areas outside the urban boundaries or rural areas, development should be managed holistically through local economic activities based on their potential to provide employment opportunities to the local population and preserve the unique character of a rural area.



STRATEGIC DIRECTION SR2 HOLISTIC LAND USE PLANNING

SR2.1 Optimising Land Use and Land Availability

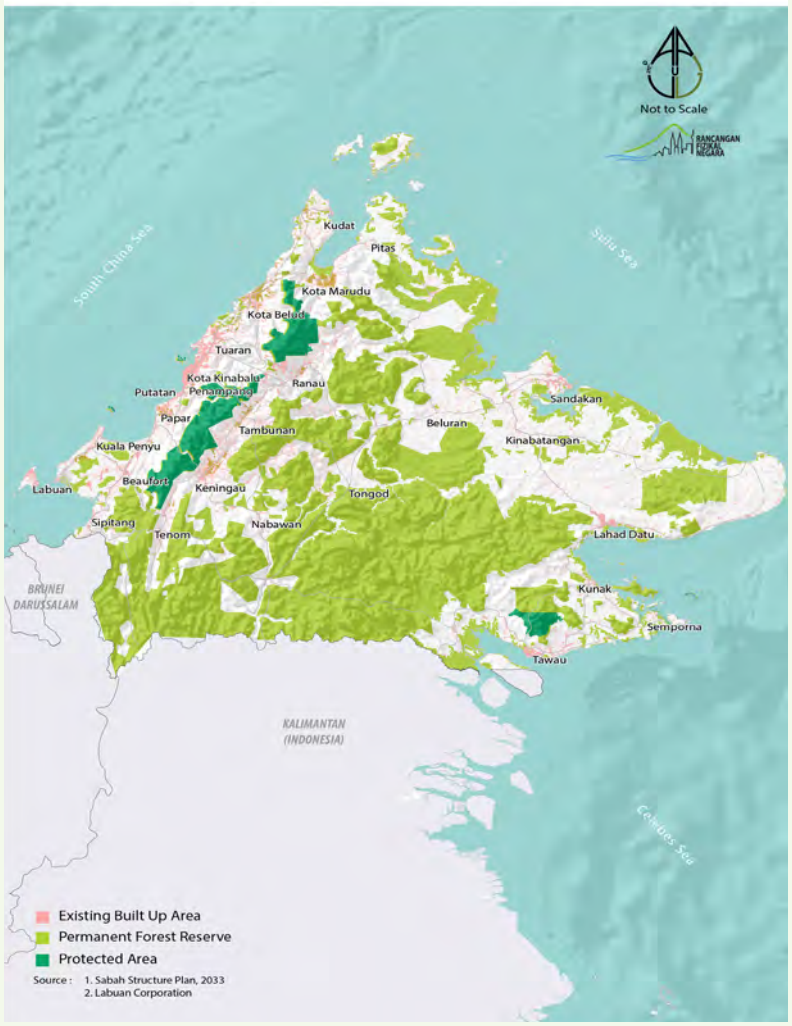
SR2.2 Managing High Risk Areas

SR2.3 Managing Development Growth and Sprawl

SR2.4 Managing Integrated Rural Development

The increase in built-up areas is expected to continue due to rising urbanisation and land use demand particularly in urban areas.

Land Use in Sabah and Federal Territory of Labuan, 2014



Box 4.12 Land Availability

Land availability refers to the remaining land other than current built-up areas (not including committed areas), ecological assets (permanent forest reserves, protected areas, heritage sites) and granary areas, all of which need to be preserved. Land availability is essential to meet the needs of future residents.

The available land in Peninsular Malaysia and Sabah comprises of agricultural areas and vacant land. However, not all of the available land can be earmarked for future development, as some of the land should be preserved for commodity crops and food production as well as for infrastructure facilities.

The total gross area of land available for future development in Peninsular Malaysia is 4.49 million hectares, or 34.11% of the total area of the peninsular. In Sabah, the total gross area of land available for future development is 1.64 million hectares of 22.13% of the state's total area.

The available land area also includes land that is exposed to risks such as floods, as well as highlands. Highlands cover 2.10% of Peninsular Malaysia's total land area while flood-prone areas account for 29.27%. Most of the available land area in Johor, Terengganu and Pahang comprises of flood-prone areas, which however can still can be repurposed for future development through appropriate mitigation measures such as strengthening of the infrastructure.

Available land area in Peninsular Malaysia

Percentage of Peninsular Malaysia

Percentage of Peninsular Malaysia

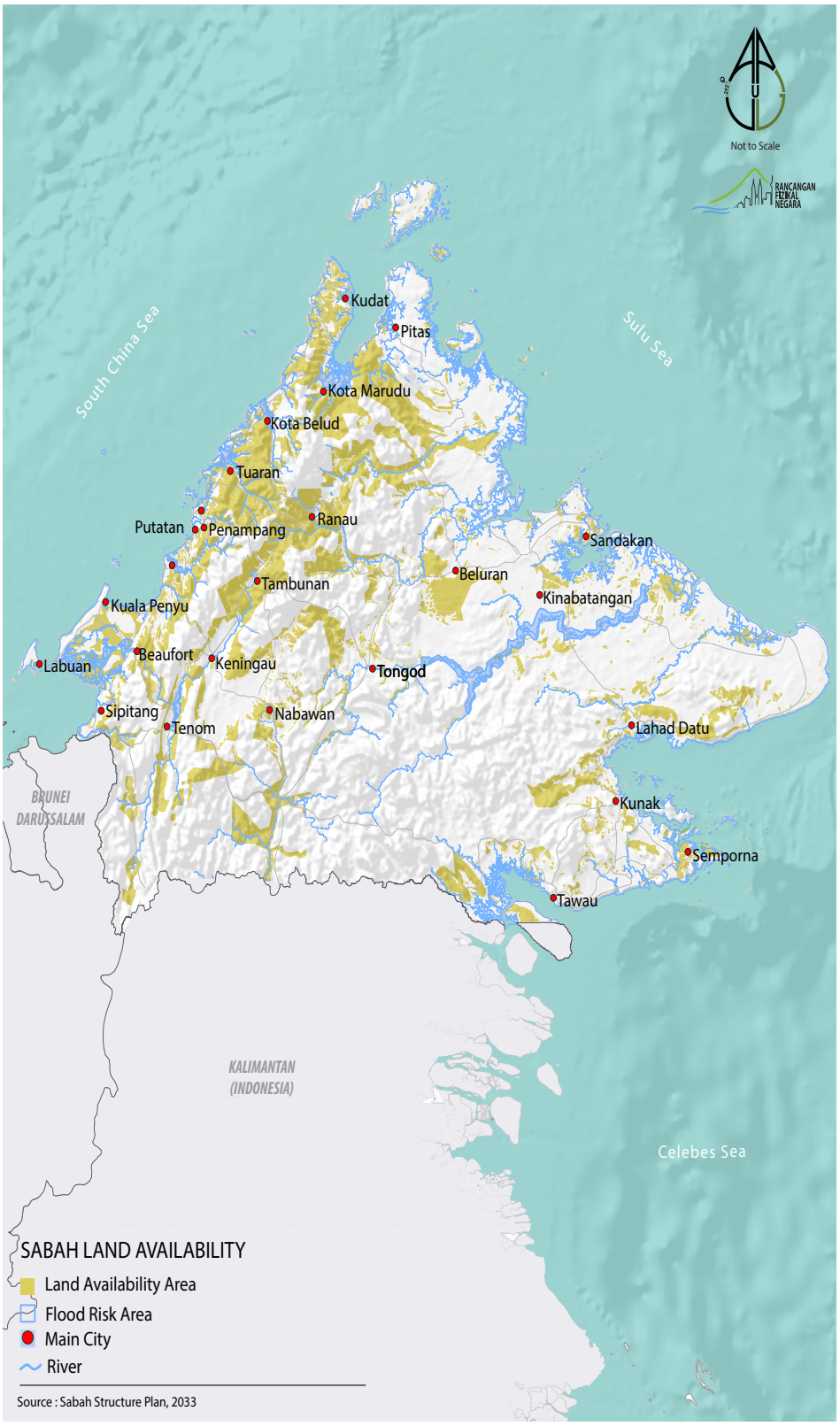
34.11%

1.64 million hectares

Available land area in Sabah

22.13%

Percentage of land area of Sabah



One example of an area that has applied flood mitigation techniques on available land is Kuala Lumpur, a small and compact area with existing developments where flash floods used to be a normal occurrence due to an inefficient drainage system, among others.

One initiative taken by the government to prevent floods in Kuala Lumpur was the construction of an underground road tunnel for flood management (SMART).

Example of flood mitigation technique in Kuala Lumpur

The SMART road and drainage project in Kuala Lumpur has the longest water diversion tunnel in Southeast Asia and the second longest in Asia.

The tunnel, built to reduce flooding and at the same time address traffic congestion in Kuala Lumpur, has somewhat reduced the incidence of floods in the city.

Box 4.13 Estimated Development Area Required in 2040

Total gross area of available land in Peninsular Malaysia that can be converted into built-up areas is 422,401 hectares, or only 3.21% of the peninsulars total land area, after taking into account the land presently covered by built-up areas, permanent forest reserves, protected areas, rice fields, and other land needed for food and commodity crops.

	PENINSULAR MALAYSIA	SABAH
Estimated Development Area Required	**4.49 million hectares**	**1.64 million hectares**
Total Land Area	**13.18 million hectares**	**7.41 million hectares**

Built-Up Areas in 2013

Area
1.17 million he
Percentage
8.91 %

Area
75,674 hectares
Percentage
2.49 %

Permanent Forest Reserves, Protected Areas, Granary Area

Area
7.50 million hectares
Percentage
56.93 %

Areea
4.68 million hectares
Percentage
63.15 %

Land Required For Food Crops

Area
3.36 million hectares
Percentage
25.46 %

Area
83,794 million hectares
Percentage
1.14 %

Land Required For Commodity Crops

Area
0.72 million hectares
Percentage
5.50 %

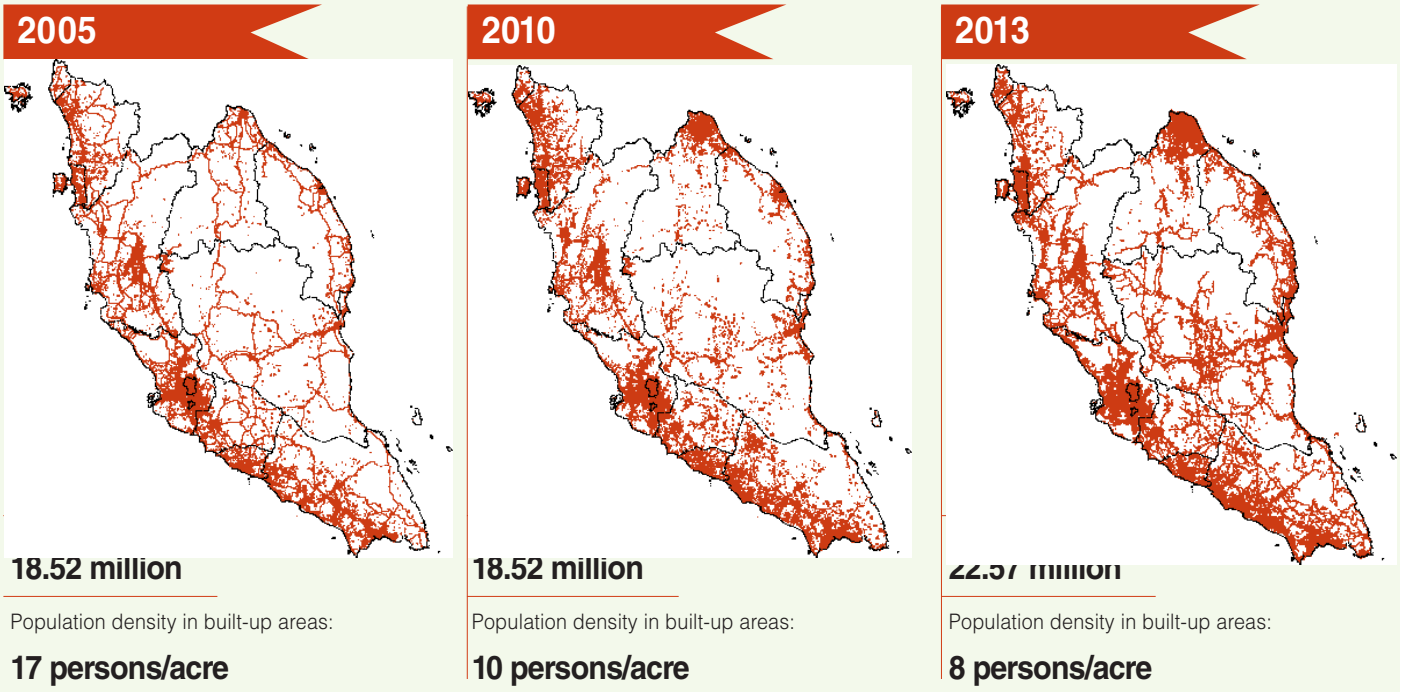
Area
487,869 million hectares
Percentage
6.58 %

SR2.1: Optimising Land Use and Land Availability

By 2040, the population of Malaysia is expected to reach 46.1 million people, whose economic, settlement, community, social and recreational needs should be catered to. As of 2013, almost 9% of Peninsular Malaysia was built-up area (in rural and urban areas). With the increase of population in the future, the need for built-up areas for economic, urban and other activities will continue to rise. In addition, the need for food and commodity crop cultivation should also be adequately catered to. Accordingly, the land use should be optimised in the existing built-up areas and in areas that have been earmarked for economic and urban growth through the following actions:

- Developing in existing developed areas;
- Developing to a sustainable density;
- Multiple land use zorning; and
- Adopting transit-oriented development approach.

Box 4.14 - Estimated Density / Population Density, Peninsular Malaysia (2005, 2010, 2013)

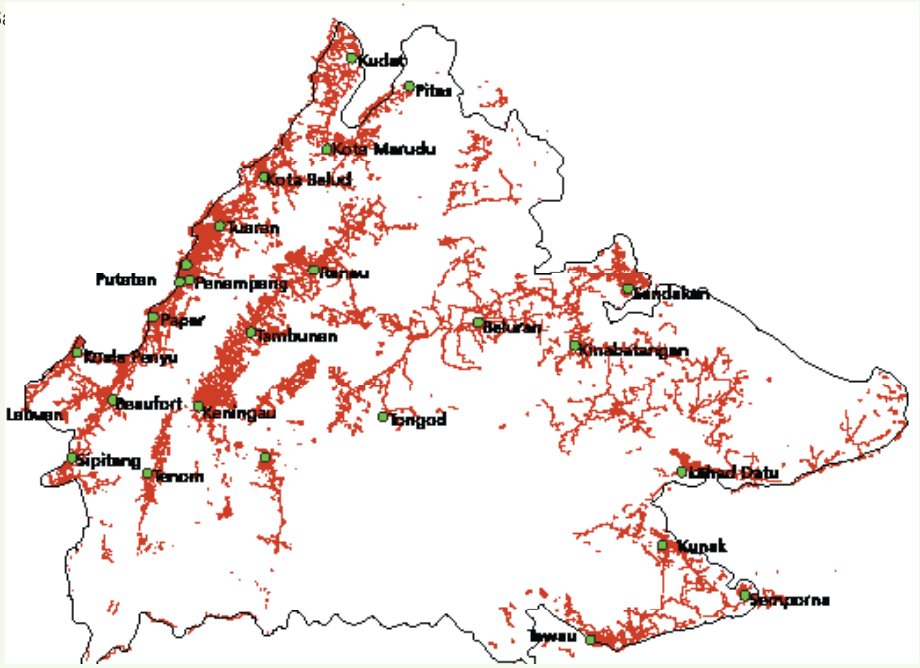


Note : For built-up areas, population and population density in 2005 and 2010, the sources are NPP and NPP-2 respectively. The population figures used for NPP (2005) and NPP-2 (2010) are the same, with both using the Department of Statistics population data for 2000.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• State Governments	• Town and Country Planning Department of Peninsular Malaysia	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning
Implementing Agency		
• Local Authorities		• Local Authorities

Box 4.15 Estimated Density /Population Density, Sa



YEAR **2013**

Percentage of built-up area to total land area:

2.49%

Total population:

3.20 million

Population density in built-up areas:

7 persons/acre

Action SR2.1A

Prioritising development in existing developed areas

Due to the increasingly limited land available for development, high-quality development that is more economical and of sustainable intensity in existing urban areas should be emphasised, in order to maximise land use effectiveness.

Development management in existing developed areas should focus on:

1. **Redevelopment of uneconomic urban areas**
   Strengthening the potential of brownfield land (industrial, commercial, etc.), infill land (vacant land between existing buildings) and areas committed to development.

2. **Reactivation or rehabilitation of existing areas**
   Reactivation or rehabilitation of dilapidated or inactive areas without involving redevelopment, population and existing community use.

3. **Discouraging the opening of new areas for development zoning**
   Discouraging the opening of new areas for development, whether small- or large-scale, if the development is not needed by the people or environment, especially in remote areas with poor access and infrastructure facilities.
   Reopening of existing but abandoned industrial areas would reduce the need to open new industrial areas.

4. **Controlling conflicting and incompatible development**
   Conflicting and incompatible development can be controlled with the preparation of State Structure Plan, Local Plan and Special Area Plan.

Box 4.16 Example of Abandoned Development Outside Existing Urban Borders

Bukit Beruntung in Serendah, Selangor is an example of an abandoned development. The development project faced financial problems, and the developer failed to complete the project, with many buildings abandoned. This mega development was initially viewed as being able to cater to the expected housing needs amid rumours that the proposed KLIA airport would be built in Hulu Selangor. However, KLIA was developed in Sepang instead, an example of the crucial role of location in boosting the development market. The nearby development in Lembah Beringin, also in Hulu Selangor district, also suffered the same fate.

Development of a project should be based on the current needs and requirements of the people, with the supporting infrastructure and public transport services planned before any development is carried out. This cautionary tale could hopefully prevent further occurrence of projects that are not well received and later abandoned, and the unnecessary clearing of rural land.

Abandoned Projects and Unoccupied Vacant Buildings in Bukit Beruntung

Source: http://isu-hari-ini.blogspot.sg/2010/04/flat-bukit-beruntung-rawang.html

Source : http://auctions.com.my/dotnet-premium/index-search.asp?Address=Bukit+Beruntung

Source : https://www.propsocial.my/location/229/bukit-beruntung

Abandoned Projects and Unoccupied Vacant Buildings in Lembah Beringin

Source : http://auctions.com.my/dotnet-premium/index-search.asp?Address=Bukit+Beruntung

Source : https://www.propsocial.my/location/229/bukit-beruntung

Box 4.17 Example of Urban Redevelopment: Pudu Jail, Kuala Lumpur

Kuala Lumpur Structure Plan 2020 has indicated the 115-year-old Pudu Jail will be redeveloped as a high-density area covering almost eight hectares. The mixed development would comprise of residential, office and commercial units, as well as cultural and recreational facilities. Part of the site near the Hang Tuah LRT Station is to be developed as a neighbourhood park.

Source: http://www.skyscrapercity.com/

Box 4.18 Example of Adaptive Reuse: Battery Factory, Johor Bahru

Cooperation among local residents, government agencies and non-governmental organisations led to a new development that has enabled the resumption of activities at the Battery Factory, a disused and derelict factory building. Repurposed as a Youth Mall. The reinvigorated building houses seven (7), restaurants, 18 food stalls and shops selling local and foreign products.

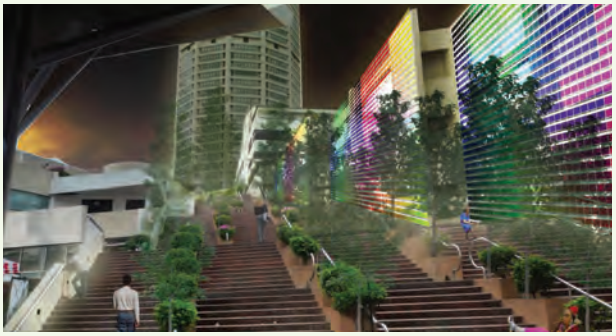
Source: Recharging the City, Presentation by Johan Ropi, 2015

Box 4.19 Example of Business Improvement District (BID) program

Development in existing developed area requires a comprehensive Action Plan outlining, among others, the Business/Community Improvement District (BID/CID) approach, which aims to reactivate derelict or inactive urban areas.

The BID approach was first adopted in Malaysia in the vicinity of Kompleks Tun Abdul Razak (Komtar) in George Town, Penang. The area had been under pressure from the new businesses spaces springing up outside the city centre. The BID initiative was aimed at restoring business based on the principles of collaboration and partnership between the owners of business premises in the BID with the Local Authority, the Penang City Council. While the council spruced up and upgraded the public spaces and landscaped the area, the private sector was tasked with promotion, security and increasing business activity.

Existing wall adjoining the stairs to the KOMTAR complex



The same location, with artist's rendering of proposed lighting for the wall

Pedestrian paths to the existing KOMTAR plaza

Artist's rendering of the same location, but spruced up and looking more inviting to pedestrians

Source: APUDG Sdn Bhd/Neuformation Arkitek

Action SR2.1B

Promoting sustainable density development

Low-density development is often regarded as not sustainable and a contributing factor to urban sprawl. More compact urban development of sustainable density would support the NPP-3 sustainable development, liveability and resilience agenda. Sustainable density measurements should be fixed by the local authority for each city or town based on local conditions and characteristics. Compact development whether of high or medium density should have the following features:

1. Within walking distance of station or transit node of high-capacity systems such as HSR, rail, ETS, LRT, MRT and BRT that is easily accessed from various destinations;
2. Fully supported by infrastructure and utility facilities, and be within the catchment area;
3. Has a range of community facilities; and
4. Promotes walking to create a walkable city.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• State Governments	• Town and Country Planning Department of Peninsular Malaysia	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Local Authorities		

Action SR2.1C

Promoting development of mixed land use zones

Mixed use zoning is one of the sustainable development principles that need to be implemented in Malaysia's urban areas. This zoning method is more flexible than single use zoning, allowing a diversity of land use activities that are compatible and conflict-free in any land use zone.

Mixed land use zoning or mixed-use development, which integrates residential, institutional and community facilities, businesses, restaurants, offices and other businesses in a single zone or development, should be designed with walkable city features. The zone should preferably be near a public transport node and the city centre.

1. **Identifing potential areas for mixed land use in the Local Plan and Special Area Plan**
   Existing compact urban areas served by public transport but still in need of support facilities and activities to meet residents' needs should be identified.

2. **Preparing guidelines on mixed land use and shared use**
   Guidelines for mixed land use development, and the desirable ratio of commercial to residential spaces or commercial to industrial spaces, should be provided. These guidelines could also serve to guide the design of shared facilities, pedestrian-friendly environments, and permitted height limits, among others.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• State Governments	• Town and Country Planning Department of Peninsular Malaysia • Department of Environment	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Local Authorities		

Box 4.20 Mixed Development: Definition and General Criteria

Mixed-use development allows multiple uses within a building or at a site, with the mix of compatible uses not leading to conflict.

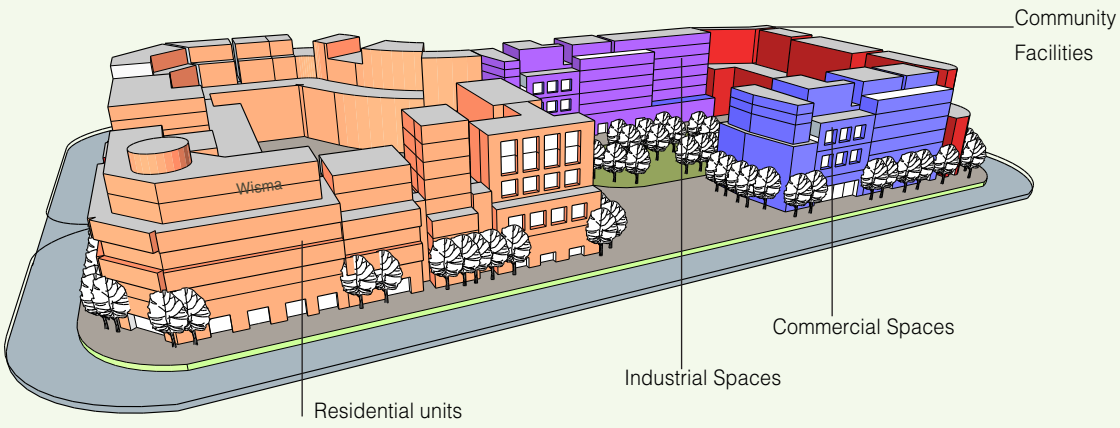
Mixed development is divided into two types:

- Horizontal mixed use, with spaces next to one another on the same floor of a building; and
- Vertical mixed use, with spaces on different floors of a building.

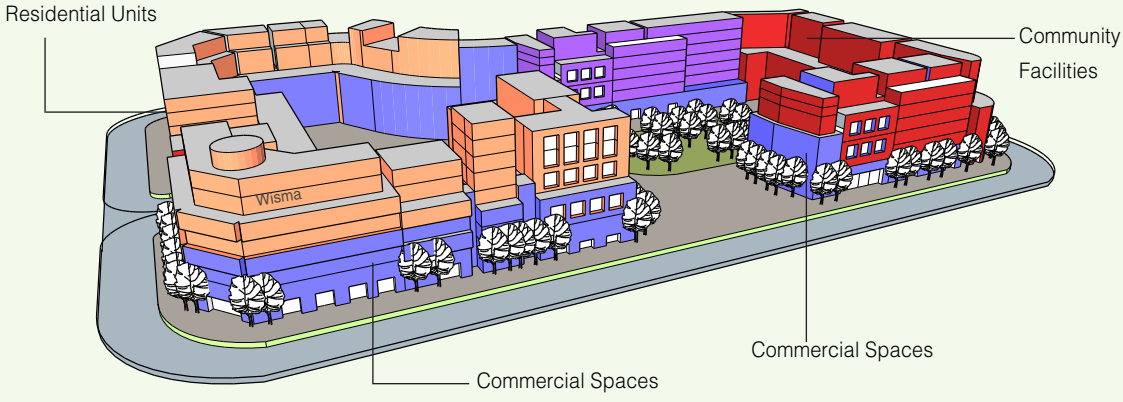
Mixed Development Criteria

- Located at the centre of the city or urban area, with a priority on uneconomic, brownfield or infill areas;
- Access and linkages to transit systems;
- Site availability for utility, infrastructure and public facilities;
- Planning control i.e. mixed land use zoning, and plot ratio which promotes cultural exchange;
- Provides convenient and easily accessible public and civic spaces that reflect the local culture;
- Improves the quality of surrounding areas through better built environment.

Horizontal Mixed Development

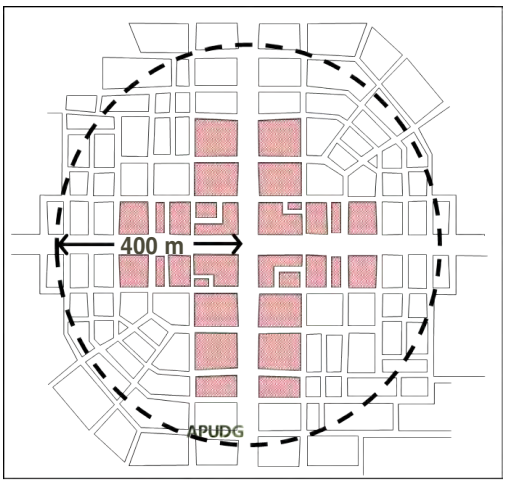


Vertical Mixed Development

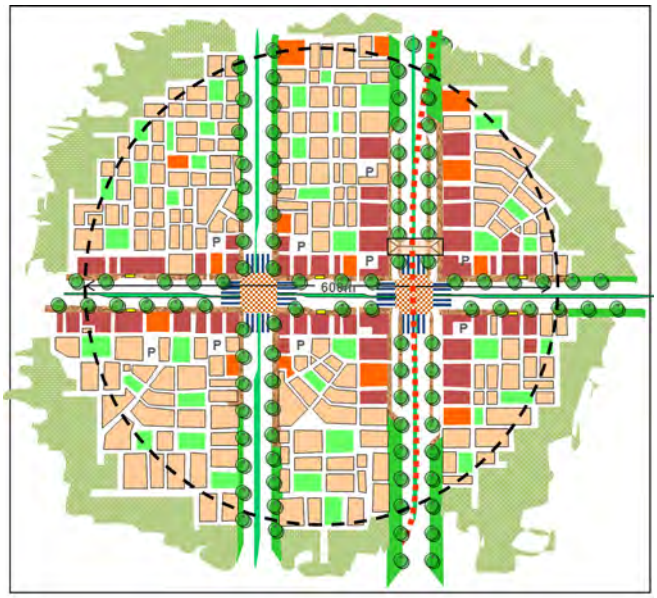


Source: National Physical Plan-3, 2015

Box 4.21 Example of Mixed Development

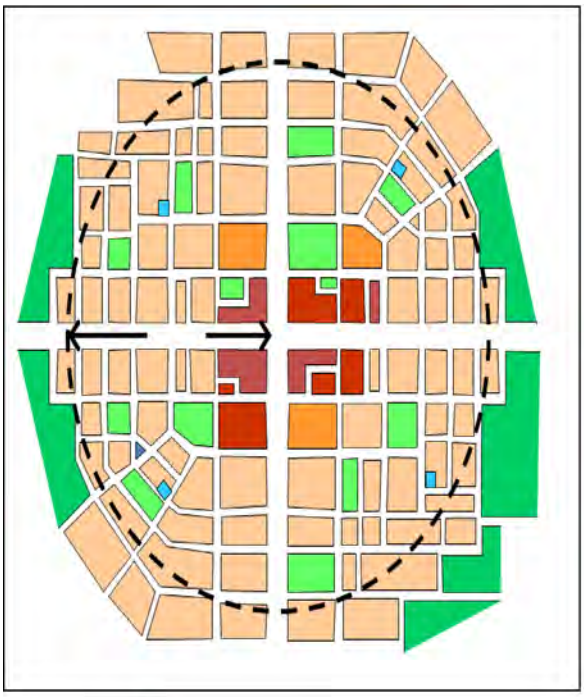


Mixed development area within 5-10 minutes' walk



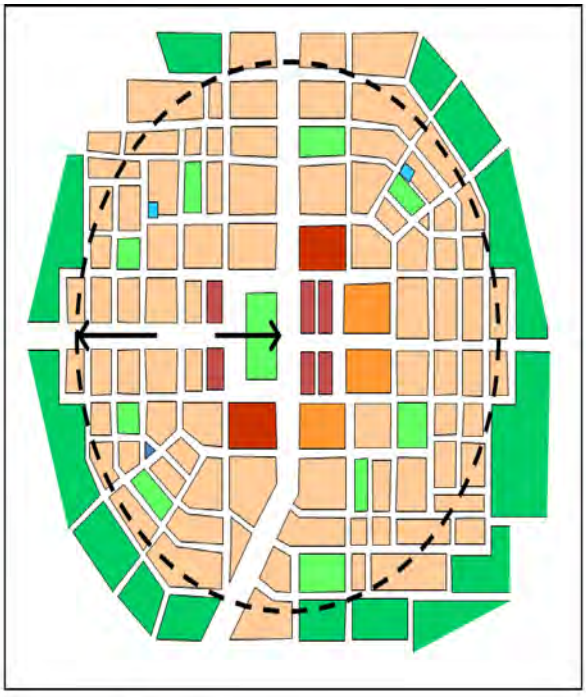
Key :-

- Retail/commercial/apartment/ office zone
- Residential zone
- Open Spaces
- Residential Fringes
- Community Facilities
- P Parking Lots
- LRT/Tram Routes
- Bus Station



Key :

- Community Facilities
- Residential Zone
- Open Spaces and School
- Mixed Development & Affordable Housing
- Commercial Units



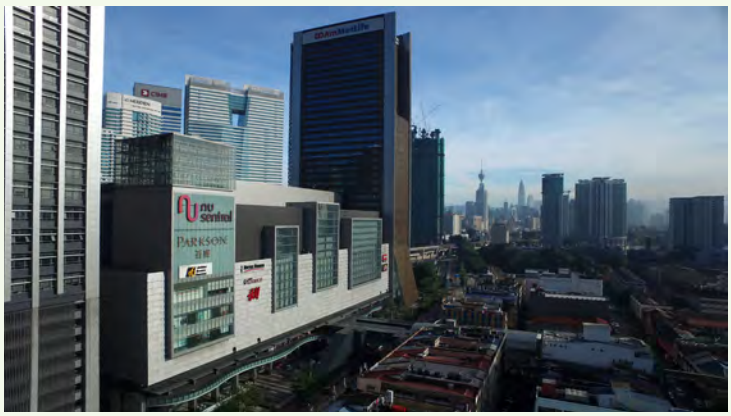
Key :

- Community Facilities
- Residential Zone
- Open Spaces and School
- Mixed Development & Affordable Housing
- Commercial Units

Source: APUDG Sdn Bhd

Box 4.22 KL Sentral, an Example of Mixed-Use Development

KL Sentral is a horizontal mixed development covering 72 acres comprising a transport hub, hotels, office buildings, apartments and shopping centres developed in phases. It is a city within a city, its components able to accommodate the needs of surrounding residents. Notable developments include the KL Sentral Station, Nu Sentral, KL Hilton Hotel, Le Méridien, St. Regis Hotel and Residences, Sooka Sentral, 1 Sentral Tower, KL Sentral Park and Suasana Sentral Loft.



Sources:
1. *http://www.lcct.com.my/others/places/kl-sentral-station*
2. *http://arizonacardinalsdailynews.com/where-to-stay-in-kuala-lumpur-sentral-malaysia/*
3. *http://runwitme.blogspot.my/2015_04_01_archive.html*
4. *http://www.klsentral.com.my/VisualGallery*

Action SR2.1D
Encouraging transit-oriented development

Transit-oriented development (TOD) should be adopted at regional and local levels in order to enhance land use efficiency and ensure maximum use of transit infrastructure. Challenges in the implementation of TOD include:

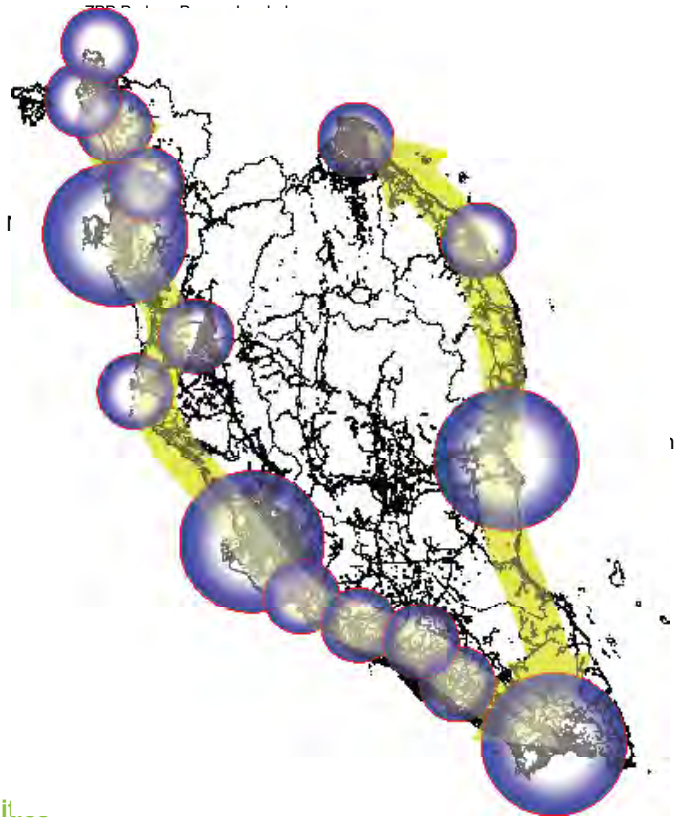
- Providing multiple uses, activities and density that are compatible with the needs of public transport users and local communities;
- Ensuring the design and facilities support the needs of users and promote the use of transit facilities; and
- Providing good quality pedestrian environment and public spaces that are safe, comfortable, easily accessible and attractive to transit users.

Transit Focused Corridor Development focuses around conurbations and Development Promotion Zones. This transit development corridor is intended to encourage development around areas oriented to High Speed Rail (HSR), Electric Train Service (ETS) and other high- and medium-speed transit systems.

Conurbations have potential as transit corridors if they have a comprehensive transit network served by a variety of public transportation systems. Each transit corridor should have a comprehensive public transport master plan in order to facilitate access to the surrounding urban areas.

This could also support the objective of making conurbations as low-carbon regions and enhancing their competitiveness. Cities and towns that are HSR and ETS hubs also have potential for transit-based development. State Governments, Local Authorities and other relevant agencies should identify, and fine-tune at the local level, areas with significant TOD potential.

Figure 4.24 Transit Oriented Development Corridor



Implementation and monitoring responsibili...

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Transport Malaysia	• Town and Country Planning Department of Peninsular Malaysia • Local Authorities	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• State Governments • Land Public Transport Commission		

Box 4.23 Example of Transit Oriented Development guidelines (Johor Public Transport Master Plan)

Definition of Transit Oriented Development

Transit-oriented development (TOD) is integrated development within walking distance of a transport transit terminal or hub.

Source: SPAD, Policy Guidelines for Transit Oriented Development, 2014.

The pedestrian catchment for the purposes of this definition refers to areas that are a 5-10 minutes' walk, or about 400 metres, from a transit hub, terminal or station.

Transit for the purposes of this definition refers to high-capacity, high-frequency modes of transport that run on routes that are separate from other traffic, and include High Speed Rail (HSR), Light Rail Transit (LRT), Mass Rapid Transit (MRT), KTM Komuter, Electric Train System (ETS) and Bus Rapid Transit (BRT), as well as similar high-capacity, high-frequency transport modes to be identified or implemented in the future.

Location of Transit Oriented Development (TOD)

Generally, TOD is only suitable in locations that have been identified as TOD areas. Not all areas with a transit terminal or station can be identified as TOD areas. A TOD location should meet all of the following criteria: -

i. There is a high-capacity, high-frequency transport transit service that runs on separate routes from other traffic, including High Speed Rail (HSR), Light Rail Transit (LRT), Mass Rapid Transit (MRT), KTM Komuter, KTM Electric Train System (ETS) and Bus Rapid Transit (BRT).
ii. There are at least two different modes of public transport, one of which must be a high-capacity high-frequency transit mode that operates on routes separate from other traffic, while the other provides shuttle services to local areas and the district.

Source: Public Transport Master Plan Johor

SR2.2: Managing Natural Disaster Risk Areas

Malaysia is considered to be in a stable geographical location that is not exposed to major natural disasters. However, in certain areas, local disasters can still occur, and can bring negative physical, social, economic and ecological impacts. These disasters include floods, coastal erosion, landslides, forest fires, earthquakes and tsunamis.

Natural disasters are the result of natural processes that are influenced by the weather, landform and geological characteristics of the area. Natural disasters become more frequent as a result of uncontrolled development activities, and will have a huge impact if they occur in high-density areas.

The areas prone to natural disasters are often regarded as high-risk areas where development should be controlled and properly carried out. Mitigation measures to reduce the impact of disasters on existing settlements and urban areas should be implemented. Land use planning for the future must take into account the impact of climate change to mitigate the impact of natural disasters on high-risk areas.

EFFECTS OF NATURAL DISASTERS

Physical:
Structural and non-structural damage to public infrastructure

Social:
Loss of life, injuries, loss of homes and sources of income

Economic:
Business activities affected, with power, water and telecommunications disruptions

Ecological:
Degradation of habitats and disturbance of natural populations of animals and plants




EFFECTS OF THE FLOODS IN 2014

- 541,896 flood victims
- 1,335 evacuation centres
- 2,076 houses destroyed
- 25 flood-related deaths
- 6,698 houses damaged
- RM2.85 billion loss in public property (excluding private and individual property)

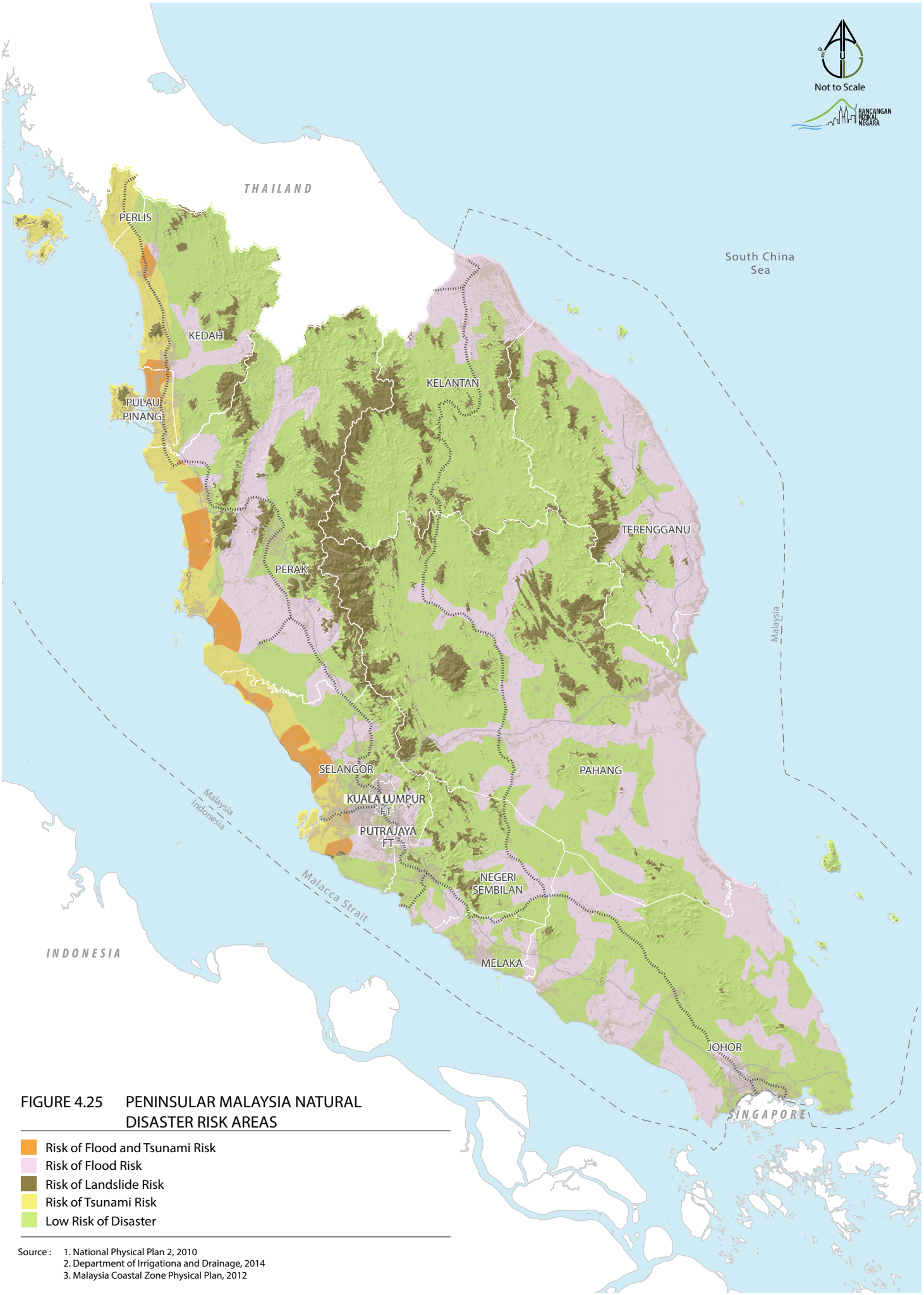


FIGURE 4.25 PENINSULAR MALAYSIA NATURAL DISASTER RISK AREAS

- Risk of Flood and Tsunami Risk
- Risk of Flood Risk
- Risk of Landslide Risk
- Risk of Tsunami Risk
- Low Risk of Disaster

Source :
1. National Physical Plan 2, 2010
2. Department of Irrigationa and Drainage, 2014
3. Malaysia Coastal Zone Physical Plan, 2012

Action SR2.2A
Strengthening flood management

Floods are the most frequent natural disasters to hit Malaysia and cause a great deal of damage. Data from the International Emergency Disasters Database (EM-DAT) shows that since 1980, a total of 33 episodes of major flooding have occurred in the country, incurring an average loss of RM915 million a year. In December 2014, big floods that hit several states in Peninsular Malaysia left 25 people dead and affected more than 500,000 people, with damage to public infrastructure amounting to RM2.9 billion. The floods in Sabah in 2014-2015 led to the evacuation of more than 5,000 victims and affected some 11,000 people, with the damage to public infrastructure estimated at RM97.4 million.

The frequency and intensity of floods is expected to increase due to the increased rainfall during the monsoon season. Apart from the physical, social and economic impacts, floods bring secondary effects such as landslides, soil erosion, sedimentation and water pollution. Flood mitigation efforts should therefore be enhanced and expanded.

1. Mapping of Flood Risk Areas

Flood risk assessment is an important aspect in flood management planning. An assessment is based on flood risk maps that show the probability of flooding of an area. Various scenarios can be mapped to evaluate the different intensities of floods and predict the effects of the disaster on human health, the environment, and economic activities.

A total of 34 flood risk maps have been produced by the Drainage and Irrigation Department for Peninsular Malaysia and Sabah. These efforts must be continued so that a more complete picture of the flood risk for the whole country, especially for high-risk urban areas, can be obtained. This is a fundamental step in the planning and management of flood areas and the implementation of mitigation measures. This information should also be taken into account in planning at the State Structure Plan, Local Plan, Special Area Plan and action plan levels.

2. Integrated Flood Mitigation Management

The Integrated River Basin Management (IRBM) approach is detailed under Action SR1.3A. The IRBM plan that is formulated must also include the management aspects of integrated flood mitigation, an approach that takes into account the natural cycle of flood waters and integrates these aspects into the management and planning for flood-risk areas. It aims to reduce the damage to property and loss of life through water and land-use management in an integrated manner involving structured and non-structured flood mitigation measures. Engineering solutions involve the construction of dams for flood control and river improvement works, while non-engineering solutions involve zoning river reserves, floodplains, wetlands and other water reservoirs. In addition, the use of Sustainable Urban Drainage Systems (SUDS) such as Bio-Ecological Drainage (BIOECODS) could help reduce the risk of flooding in an area.

a. Fully adopt Urban Storm Water Management

The Urban Storm Water Management has been introduced as a non-structural measure to contribute to flood mitigation in urban areas, particularly in new developments. The Urban Storm Water Management suggests best practices to control runoff from the source, as well as flood mitigation measures. Under the Urban Storm Water Management , reservoirs and river coastal areas should be integrated in a continuous network to form a buffer zone against flooding.

b. Compliance with Storm Water Management and Drainage Master Plan

The Storm Water Management and Drainage Master Plan has been prepared for the following areas:

i. Selangor Kajang, Klang, Sungai Buloh, Puchong and Sungai Besi;
ii. Perak, Ipoh, Manjung, Sitiawan, Lumut, Parit Buntar and Bagan Serai;
iii. Kelantan: Pasir Mas and Tanah Merah;
iv. Terengganu: Dungun;
v. Perlis: Kangar, Arau and Padang Besar;
vi. Pahang: Kuantan
vii. Johor: Iskandar Malaysia and Pasir Gudang;
viii. Sarawak: Kuching, Kota Samarahan and Miri; and
ix. Sabah: Tawau, Menggatal, Telipok and Tuaran.

The plans should be used as guidelines for development planning and land development in the area. Legal provisions and more effective enforcement of compliance with the Storm Water Management and Drainage Master Plan should be established in each state.

3. Implementating Flood Mitigation Plan for Rural Areas

For rural areas, there are measures to control floods, especially those involving larger areas. A Flood Mitigation Plan (FMP) has been prepared for the river basins of Sungai Muda (Kedah), Sungai Muar (Johor), Sungai Bunus (Kuala Lumpur) and Sungai Kurau (Perak) as well as for Pekan (Pahang). A total of 194 flood mitigation projects have been carried out, but they should be expanded to other critical areas.

FMP measures include:

a. Provision of detention ponds and drainage infrastructure in appropriate areas;
b. Gazetting of vacant land as reservoirs and restricting development in the area; and
c. Carrying out maintenance of abandoned water-retaining ponds.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Federal Territory of Labuan</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th>Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Urban Wellbeing, Housing and Local Government
• Ministry of Natural Resources and Environment</td><td rowspan="3">• Town and Country Planning Department of Peninsular Malaysia
• Department of Survey and Mapping Malaysia
• Local Authorities
• National Security Council
• National Disaster Agency</td><td rowspan="3">• Sabah Ministry of Local Government and Housing
• Ministry of Infrastructure Development
• Sabah Town and Country Planning Department
• Department of Irrigation and Drainage
• Local Authorities
• National Security Council
• National Disaster Agency</td></tr>
<tr><th>Implementing Agency</th></tr>
<tr><td>• State Governments
• Department of Irrigation and Drainage Malaysia</td></tr>
</table>

Action SR2.2B
Conserving coastal areas

Malaysia's 4,809 km-long coastline is of economic, social and ecological importance. In Peninsular Malaysia, almost 31% of the population live and work in the coastal zones, whose important natural habitats are threatened by urban and coastal development.

Along Sabah's 1,743 km-long coastline, major cities and towns have grown rapidly. This zone also hosts important natural habitats which are under threat from urban, coastal and beach development.

The dynamic coastal areas are affected by natural physical factors such as sea currents and waves. Since the 1980s, the coastal areas of Malaysia have been identified as areas threatened by erosion. According to the DID, 1,415 km of coastline in Malaysia faces erosion, with 20.4% categorised as critical (Category 1).

Coastal erosion may cause damage to public infrastructure, settlements and buildings, besides threatening sensitive natural habitats. In the future, the shoreline will be exposed to more frequent and more intense storms, with the wave action bringing more visible impacts due to the effects of climate change. In the long term, sea level rise will increase the risk to structures in coastal areas. The following measures should be taken to conserve coastal areas:

1. Control of Development in Coastal Areas

Damage to infrastructure and utilities, community facilities, settlements and buildings can be reduced if development in coastal areas is well designed.

a. Integrated Shoreline Management Plan

An Integrated Shoreline Management Plan (ISMP) takes into account the needs of all sectors and activities involved in the coastal areas. This plan includes an assessment of the area and a proposed management strategy, including specific guidelines for development activities. The DID has prepared an ISMP for the following:

i. Pahang;
ii. Melaka;
iii. Negeri Sembilan;
iv. Pulau Pinang;
v. Labuan;
vi. Miri (Sarawak);
vii. West Coast of Sabah; and
viii. West Coast of Johor.

The ISMP should be used as a reference for the development planning and conservation of coastal areas. For those states still without an ISMP, its preparation should be a priority.

b. National Coastal Zone Physical Plan (NCZPP)

The National Coastal Zone Physical Plan (NCZPP), 2008-2030 is a strategic land use plan which outlines the strategic direction for the use, conservation, and management of the coastal resources in Peninsular Malaysia. The plan should be expanded to become one of the main guidelines in the formulation of the State Structure Plan and Local Plan for the development and conservation of coastal areas.

2. Conservation of Coastal Areas in Critical Condition

Mitigation efforts should be carried out for the coastal areas that are in critical condition. Coastal habitats, especially mangroves, coral reefs and mudflats should be preserved. Non-structured engineering measures should be the key strategy in coastal defence efforts. More environmentally friendly initiatives could be introduced such as reclamation of beach sand, mangrove replanting, geotextile tubes, beach drainage and embankment stabilisation. If non-structured engineering measures cannot be carried out, structured engineering measures can be implemented.

3. Coastal Vulnerability Index (CVI) Study for Malaysia

Efforts to identify the effects of sea level rise on the country's coastal areas should be carried out so that adaptation and mitigation measures can implemented as early as possible. The Impact Study on Sea Level Rise in Malaysia by NAHRIM is the basis for the Sea Level Rise Follow-Up Study in the following areas:

a. Sandakan, Sabah (2012);
b. Kuala Terengganu, Terengganu (2012);
c. Langkawi, Kedah (2013);
d. Batu Pahat, Johor (2015);
e. Kuantan and Pekan, Pahang (ongoing);
f. Lumut and Pangkor, Perak (ongoing); and
g. Port Klang, Selangor (on-going).

3. Controlling Reclamation Activities in Coastal Areas

Coastal zones should be preserved and conserved to prevent the loss and degradation of natural habitats and increased soil erosion along the coast due to physical development activities, particularly land reclamation and dredging.

For this purpose, no land reclamation or dredging is permitted, except where:

a. These activities can be clearly demonstrated to make a significant socio-economic contribution to the state and nation (such as infrastructure development); and
b. The activities do not significantly affect the environment.

However, land reclamation or dredging is not permitted in the following areas:

a. Mangrove forests and wetlands that have been gazetted as protected areas;
b. Environmentally sensitive areas in accordance with the Planning Guidelines (see SR1.2);
c. Conservation and Development of Coastal ESA;
d. Other areas recognised as having high ecological, cultural and economic value; and
e. Coastal Protection Zones identified in the NPP-3 (refer to Figure 4.25, Chapter 2 and Chapter 6)

Any proposed reclamation or dredging activity should be referred to the NPPC for Peninsular Malaysia and the State Cabinet for Sabah for approval before being granted development approval, ownership of the land or development agreement between the State and related parties. Each development plan involving land reclamation or dredging should be included in the development plan before such activities are allowed.

In addition to meeting the requirements of existing development, in any planning for land reclamation and dredging, studies should be carried out, taking into account the following aspects:

a. Impacts on erosion and sedimentation along the coastal areas namely through hydrological analysis and beach hydraulics;
b. Impacts on animal and plant populations as well as natural habitats;
c. Impacts of climate change, including rising sea levels over a period of not less than 100 years;
d. Compatibility of design with existing shoreline;
e. Use of uncontaminated reclaimed material, which may negatively affect the natural coastal and sea habitats; and
f. Provision of a passage for local residents to coastal areas (except for restricted areas).

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Natural Resources and Environment • Ministry of Urban Wellbeing, Housing and Local Government • Town and Country Planning Department of Peninsular Malaysia • State Governments	• Department of Environment • Department of Lands and Mines • Public Works Department • Land and District Offices	• Tourism Ministry • Sabah Ministry of Culture, Tourism and Environment • Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Department of Environment • Department of Irrigation and Drainage • Local Authorities
Implementing Agency		
• Department of Irrigation and Drainage Malaysia • Local Authorities		

A coastal area in Kuala Terengganu

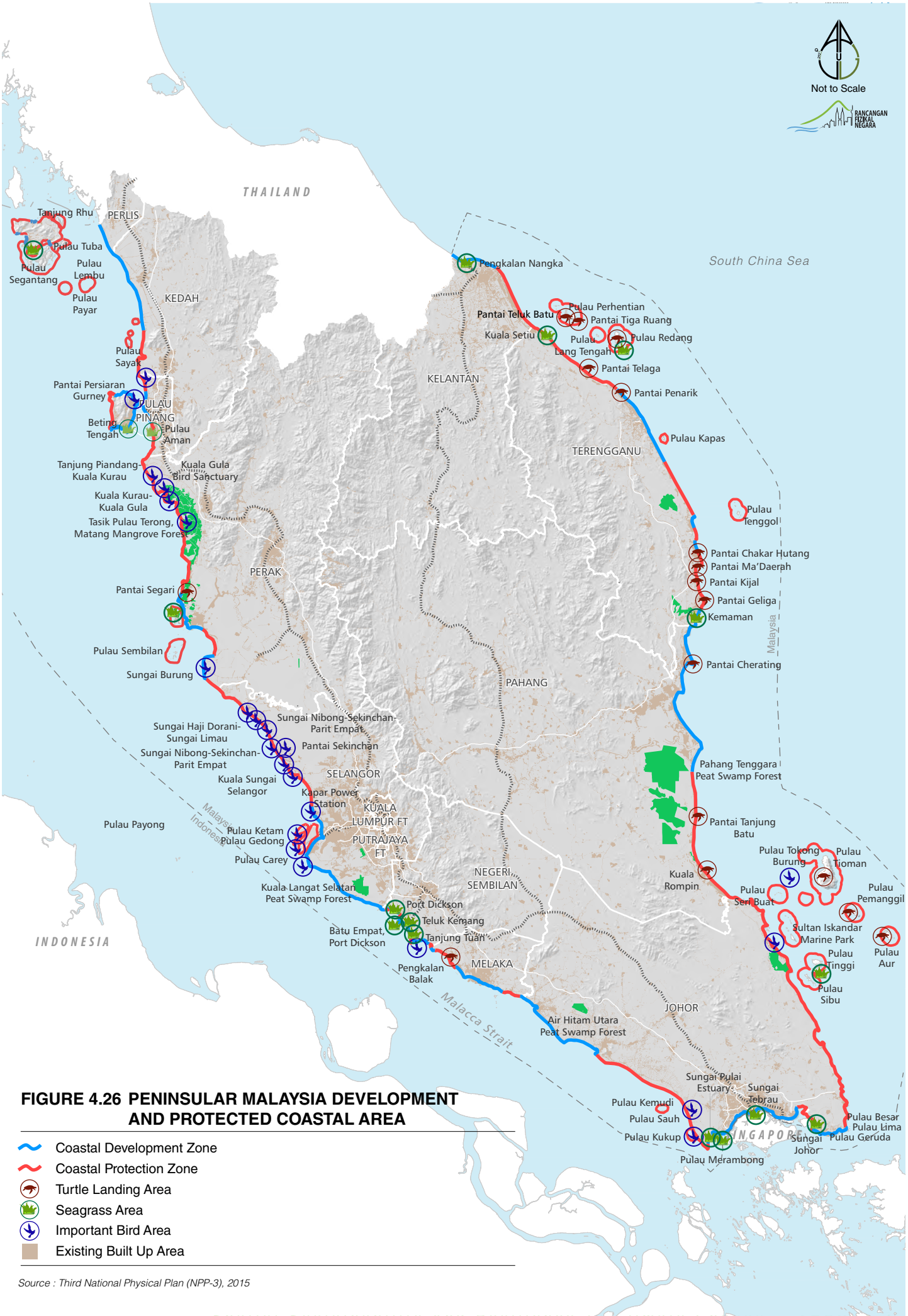


FIGURE 4.26 PENINSULAR MALAYSIA DEVELOPMENT AND PROTECTED COASTAL AREA

- Coastal Development Zone
- Coastal Protection Zone
- Turtle Landing Area
- Seagrass Area
- Important Bird Area
- Existing Built Up Area

Source : Third National Physical Plan (NPP-3), 2015

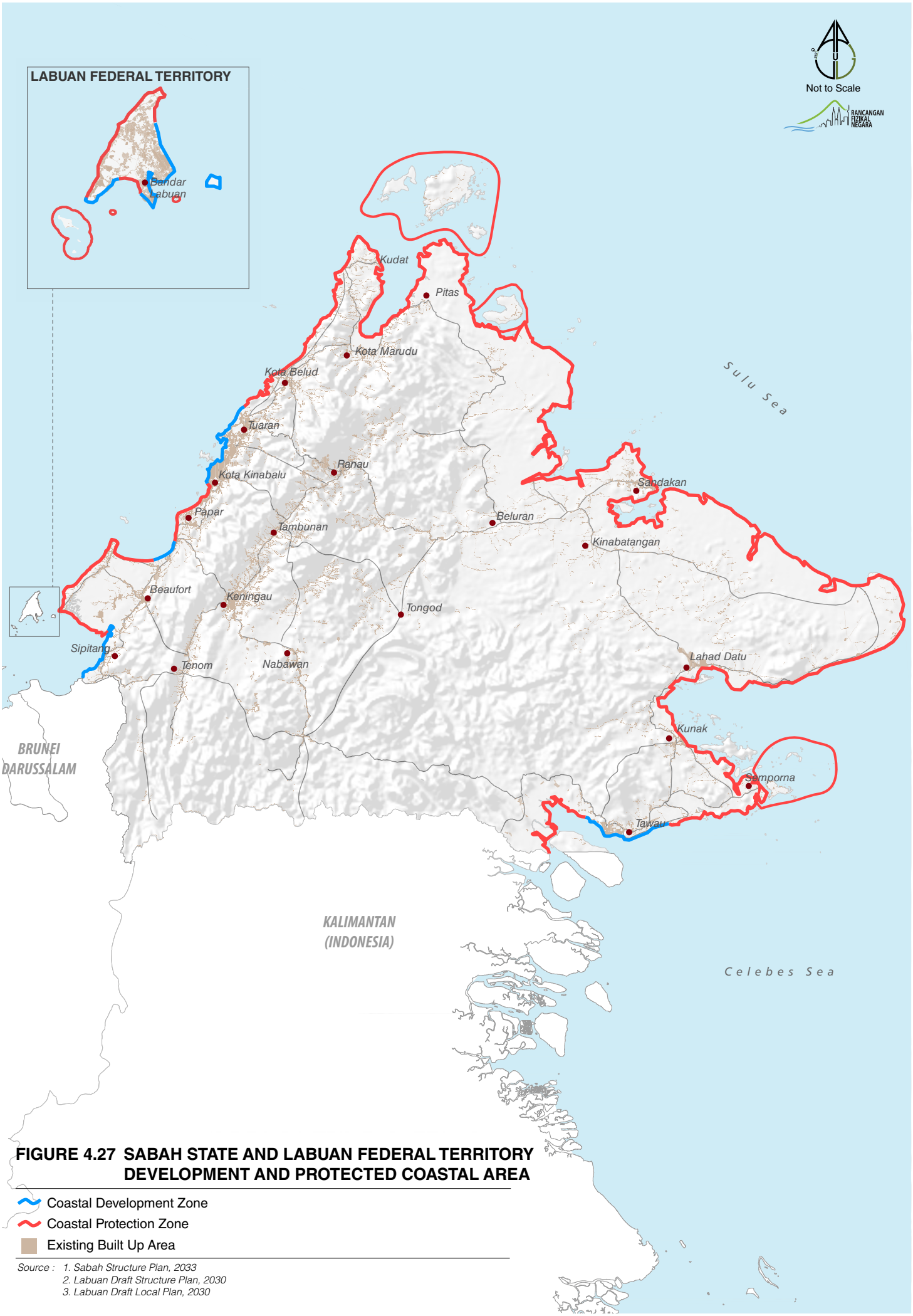


FIGURE 4.27 SABAH STATE AND LABUAN FEDERAL TERRITORY DEVELOPMENT AND PROTECTED COASTAL AREA

- Coastal Development Zone
- Coastal Protection Zone
- Existing Built Up Area

Source : 1. Sabah Structure Plan, 2033
2. Labuan Draft Structure Plan, 2030
3. Labuan Draft Local Plan, 2030

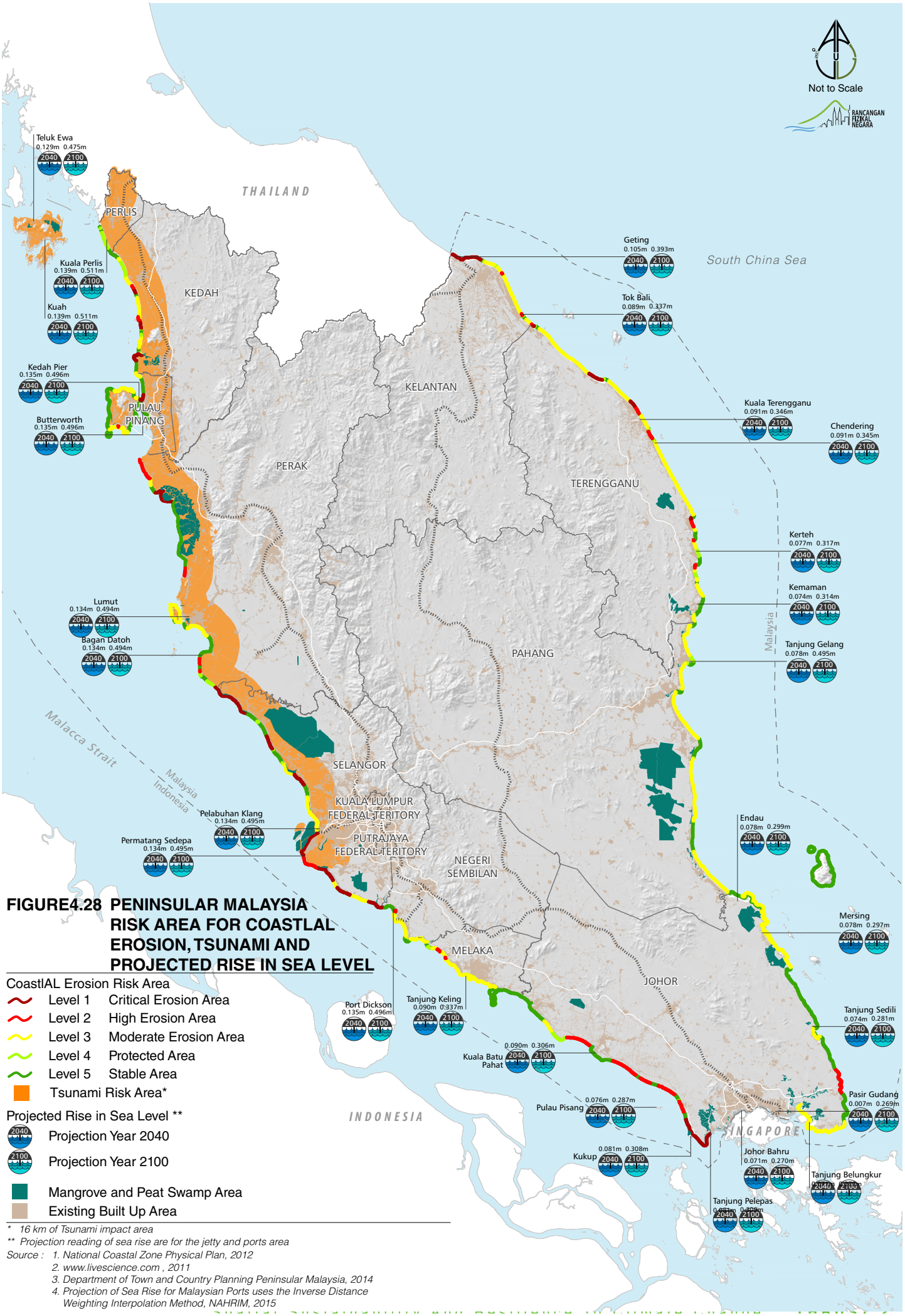


FIGURE4.28 PENINSULAR MALAYSIA RISK AREA FOR COASTLAL EROSION, TSUNAMI AND PROJECTED RISE IN SEA LEVEL

CoastlAL Erosion Risk Area

- Level 1 Critical Erosion Area
- Level 2 High Erosion Area
- Level 3 Moderate Erosion Area
- Level 4 Protected Area
- Level 5 Stable Area
- Tsunami Risk Area*

Projected Rise in Sea Level **

- 2040 Projection Year 2040
- 2100 Projection Year 2100

- Mangrove and Peat Swamp Area
- Existing Built Up Area

* 16 km of Tsunami impact area

** Projection reading of sea rise are for the jetty and ports area

Source : 1. National Coastal Zone Physical Plan, 2012
2. www.livescience.com , 2011
3. Department of Town and Country Planning Peninsular Malaysia, 2014
4. Projection of Sea Rise for Malaysian Ports uses the Inverse Distance Weighting Interpolation Method, NAHRIM, 2015

Action SR2.2C
Managing landslide risks

Landslides are caused by various factors such as terrain, soil characteristics, rock type and precipitation intensity. Landslides usually cause damage to buildings, infrastructure and utilities, while their secondary impacts can obstruct rivers and cause flooding in downstream areas. Landslides are more common in the highlands and high slope areas that are affected by human activities such as development and deforestation. Action SR1.2 has identified the management of this area through the ESA framework and existing guidelines, so that the landslide risk can be reduced.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Federal Territory of Labuan</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th>Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Urban Wellbeing, Housing and Local Government

Implementing Agency

• State Governments</td><td>• Town and Country Planning Department of Peninsular Malaysia
• Mineral and Geoscience Department Malaysia
• Local Authorities
• Land and District Offices
• Public Works Department
• National Security Council
• National Disaster Agency</td><td>• Sabah Ministry of Tourism, Culture and Environment
• Sabah Ministry of Local Government and Housing
• Sabah Department of Town and Regional Planning
• Department of Environment
• Public Works Department
• Mineral and Geoscience Department
• National Security Council
• National Disaster Agency</td></tr>
</table>

Action SR2.2D
Controlling forest and peat soil fires

Forest and peat soil fires could result in the loss and degradation of natural habitats and bring secondary effects such as water pollution, soil erosion and a reduction in the water capacity of catchment areas. The fires also cause greenhouse gas emissions and are a source of local haze.

Haze affects health, the economy and the environment. Although forest and peat fires can be due to natural causes, they are often caused by human activities. According to the National Aeronautics and Space Administration (NASA), in 2014, a total of 1,218 hotspots were recorded in Peninsular Malaysia with 106 hotspots in Sabah. The risk of fires is expected to rise in the dry season.

1. Peatland Management

Peat forms in lowland areas with a high content of natural water. Peat contains organic substances deposited to a depth of at least 50cm; it undergoes partial oxidation in an aqueous environment, giving the soil a high carbon content.

Peatlands play a crucial role in the lives of humans and wildlife due to their spaciousness, multiple functions and value of the products derived from them. Peat is a significant reservoir of carbon, water and biodiversity. With land clearing activities and infrastructure construction, the natural flow is interrupted, causing peat to become dry and flammable.

Several initiatives have been undertaken to manage and prevent fires in peatland areas, namely:

a. Improving Fire Danger Rating System (FDRS) which is a classification system for areas with a high fire risk i.e. where an early warning can be identified.
b. The program for the Prevention and Management of Inflammable Peat has been implemented in Selangor, Melaka, Negeri Sembilan, Kuala Lumpur, Pahang, Johor and Putrajaya to monitor the water level so that peatlands do not experience significant drying through the construction of viewing towers, check-dams/canal blocking, tube wells, water supply pipes and temporary reservoirs.
c. These efforts should be enhanced and extended to other peat areas below:
    i. Selangor: Sungai Karang Forest Reserve, Raja Musa Forest Reserve and Kuala Langat Forest Reserve (North and South);
    ii. Pahang: Resak Rompin Forest Reserve, Nenasi Forest Reserve, Pekan Forest Reserve and Kuala Kemaman Forest Reserve;
    iii. Johor: Jemaluang Forest Reserve, Gunung Arong Forest Reserve, Tenggaroh Forest Reserve and Ayer Hitam Forest Reserve;
    iv. Terengganu: Bukit Sai Forest Reserve, Mercang Forest Reserve and Bukit Terendak Forest Reserve;
    v. Sabah: Klias Peninsula Forest Reserve, Lower Kinabatangan-Segama Wetlands, and Lower Kinabatangan Wildlife Sanctuary.

d. Various measures have already been implemented by State Forestry Departments to prevent and control fire in permanent forest reserves, including education and awareness campaigns, and monitoring of fire incidents on the ground and from the air with the use of drones/UAVs in collaboration with the relevant government agencies and local communities.

The FDRS managed by the Malaysia Meteorological Department is used to improve the early warning system for fire-prone areas, to allow preparatory and preventive measures to be taken, especially in dry weather. Every major peat swamp forest in Selangor and Pahang has an Integrated Forest Management Plan prepared to enhance their conservation and management. Harvesting licenses are required to provide a fire action plan for their own area. These efforts should be extended and implemented holistically to improve preparedness for the dry season ahead.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government	• Department of Environment Malaysia • Department of Irrigation and Drainage Malaysia • Department of Forestry Peninsular Malaysia • Meteorological Department • Mineral and Geoscience Department Malaysia • Town and Country Planning Department of Peninsular Malaysia • Fire and Rescue Department Malaysia • National Security Council • National Disaster Agency • Local Authorities	• Sabah Forestry Department • Fire and Rescue Department Malaysia • Department of Environment Malaysia • Sabah Ministry of Tourism, Culture and Environment • Department of Environment • Department of Irrigation and Drainage • National Security Council • National Disaster Agency • Local Authorities
Implementing Agency		
• State Governments		

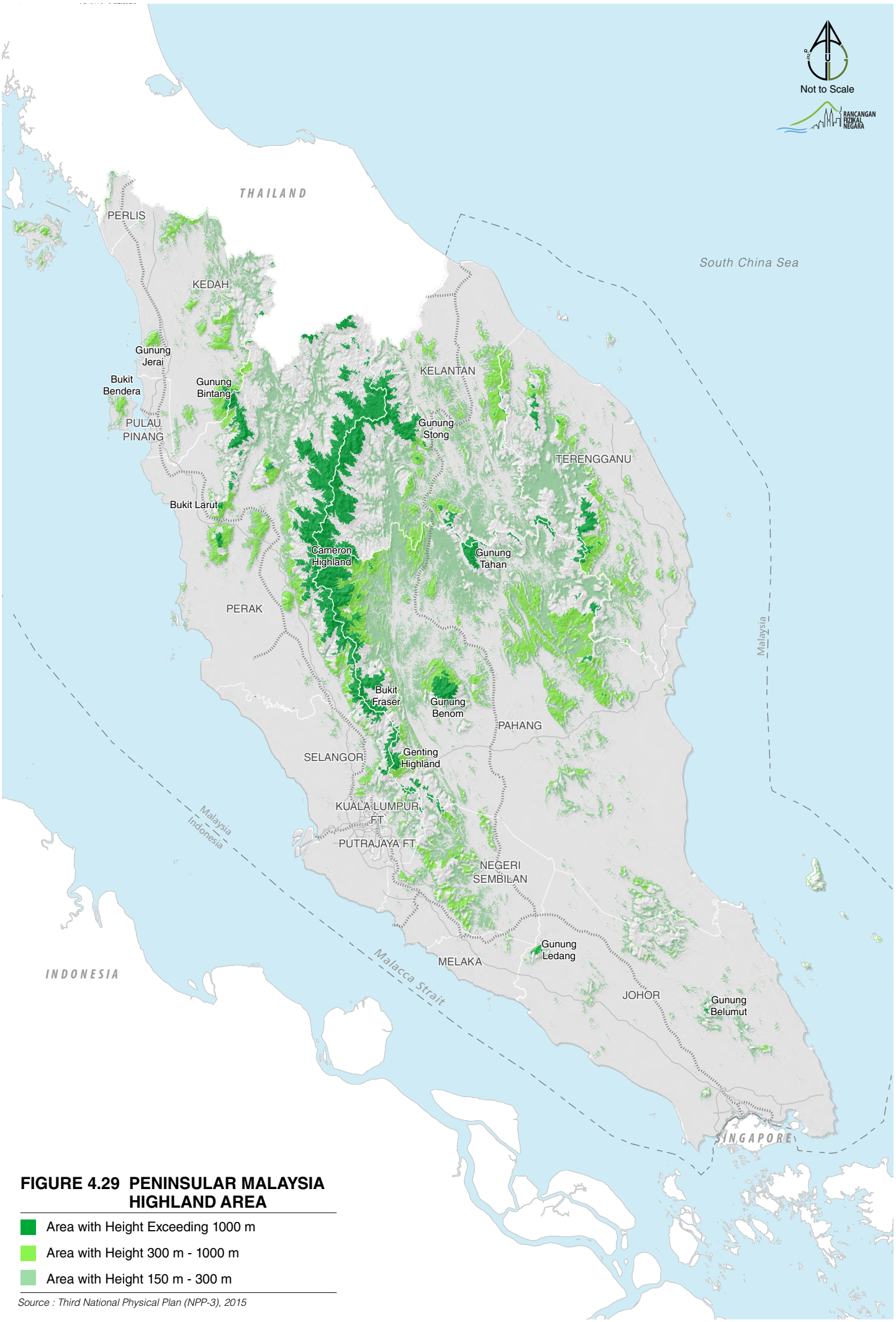


FIGURE 4.29 PENINSULAR MALAYSIA HIGHLAND AREA

- Area with Height Exceeding 1000 m
- Area with Height 300 m - 1000 m
- Area with Height 150 m - 300 m

Source : Third National Physical Plan (NPP-3), 2015

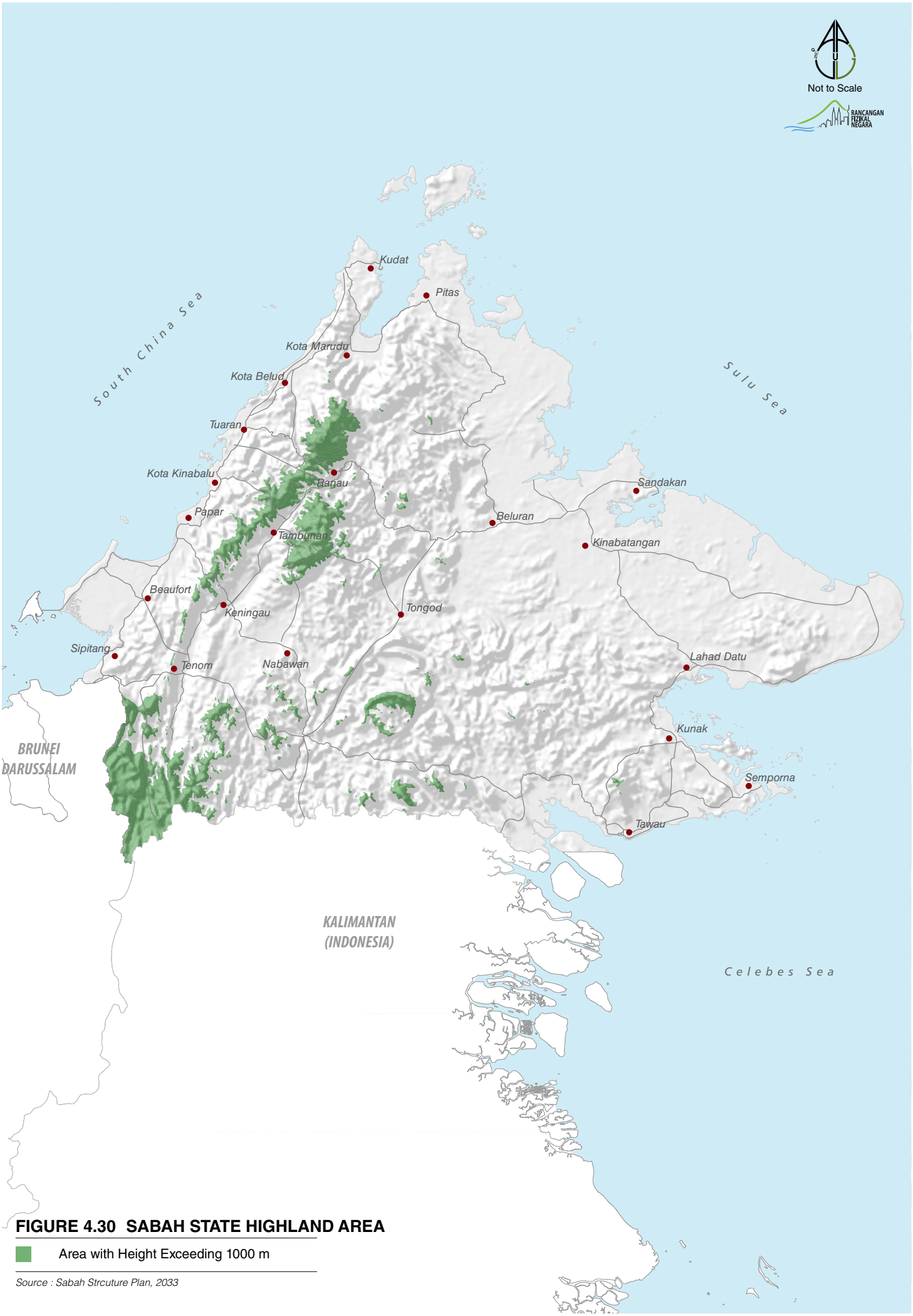


FIGURE 4.30 SABAH STATE HIGHLAND AREA

Area with Height Exceeding 1000 m

Source : Sabah Strcuture Plan, 2033

FIGURE 4.31 FOREST FIRE LOCATION 2010 - 2014

- Forest Fire Location (2010 - 2014)
- Peat Swamp Forest Area
- Forest Area

Source : NASA, Fire Information for Resourse Management System (FIRMS), 2015

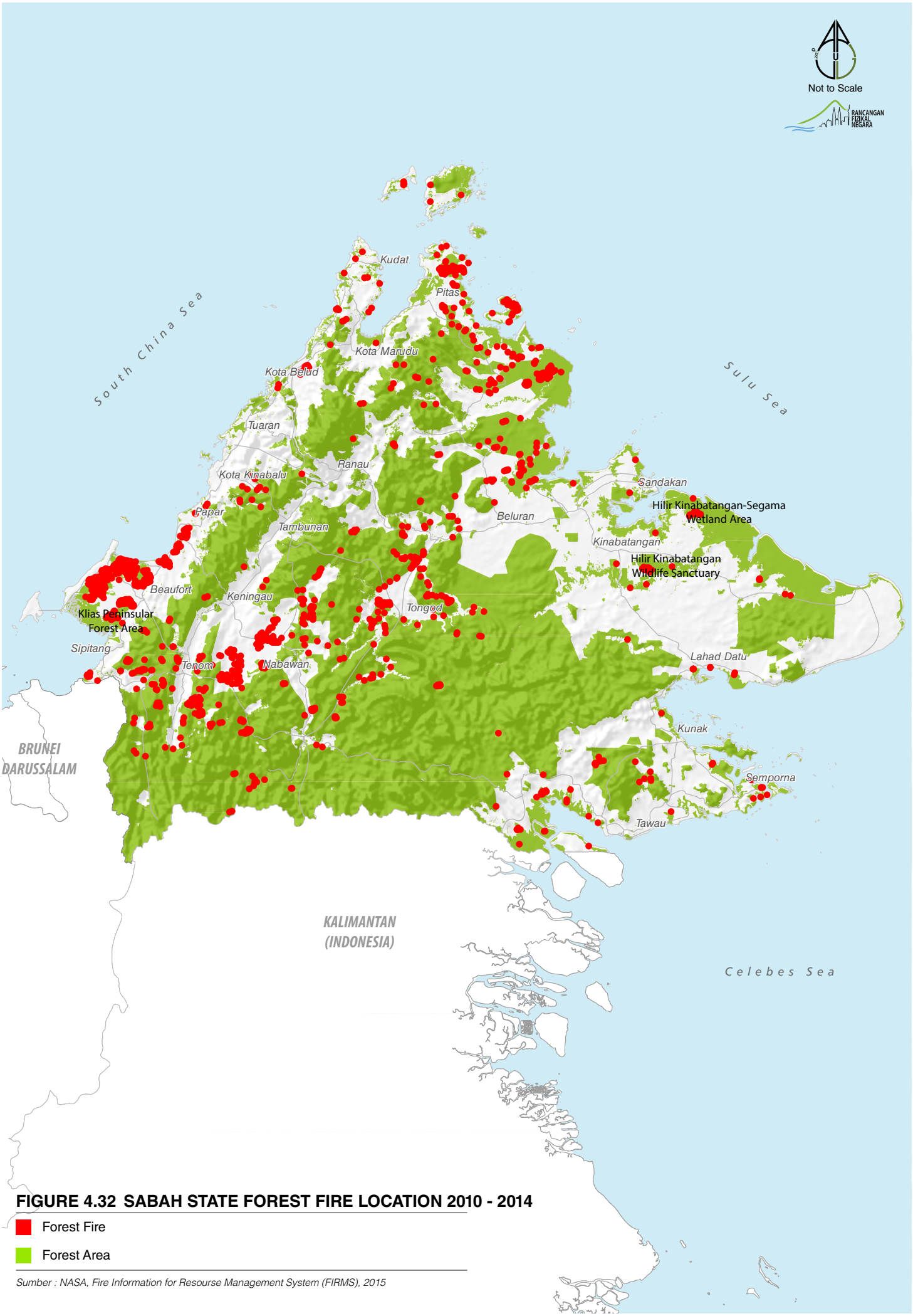


FIGURE 4.32 SABAH STATE FOREST FIRE LOCATION 2010 - 2014

Forest Fire

Forest Area

Sumber : NASA, Fire Information for Resourse Management System (FIRMS), 2015

Action SR2.2E
Improving level of earthquake preparedness

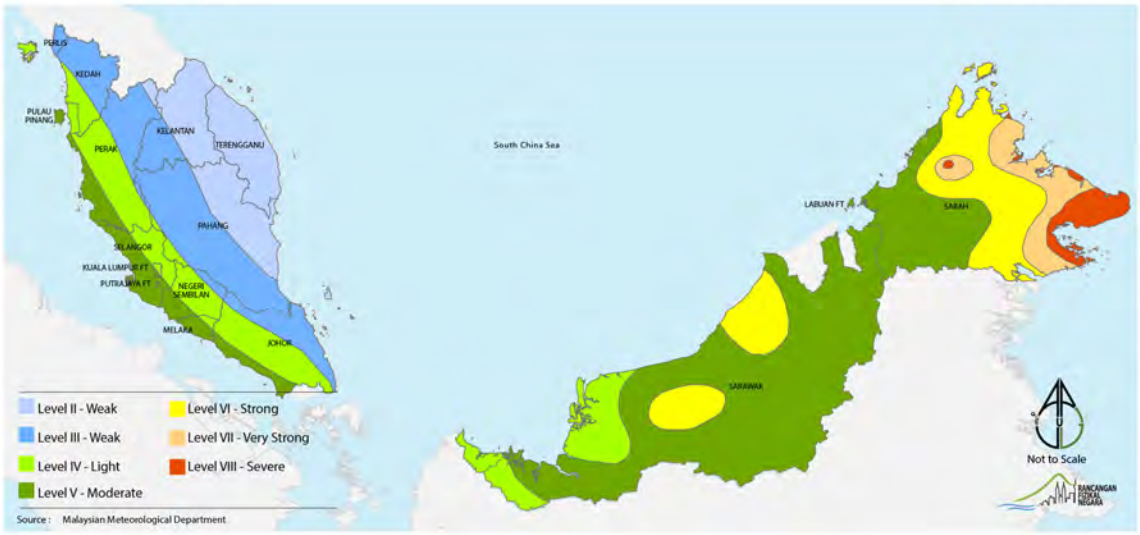
An earthquake occurs on the Earth's surface due to the sudden release of energy from the Earth's crust that creates seismic waves. Generally, Malaysia is seismically stable and has a low earthquake risk. However, Sabah and Sarawak often suffer weak earthquakes, based on information from the International Emergency Disasters Database (EM-DAT). Since the late 1800s, as many as 80 earthquake episodes have been recorded in Sabah, with 21 in Sarawak.

Earthquakes can cause damage to infrastructure, utilities, buildings, loss of life and landform, depending on the place and time of the earthquake. The earthquake in Ranau, Sabah on 5th June 2015, rated 6.0 on the Richter scale, killed 18 people and caused damage to infrastructure and buildings totalling almost RM100 million. This incident has raised public awareness of the
impacts of earthquake and the need to prepare appropriately.

Areas in Sabah which often suffer from weak earthquakes are Ranau, Lahad Datu, Labuk Sugut, Kinabatangan, Sandakan, Kunak, Semporna and Tawau. For these areas, development planning should be more thoroughly prepared for the impacts of the earthquake and be capable of reducing the risk of injury and loss of life of civilians. The development guidelines on the following aspects should be adhered to:

a. Identification of areas that are not suitable for development;
b. Use of earthquake-resistant construction materials and design for buildings and new infrastructure; and
c. Improvement of existing structures to deal with earthquakes.

Figure 4.33 Maximum Intensity of Earthquakes in Sabah and Sarawak (1875-2007) on MMI Scale *



** Modified Mercalli Intensity (MMI) is the level of impact of the observed effect of the earthquake. A low-level earthquake is felt even by civilians, while a high level is associated with structural damage.*

Source: Meteorological Department

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Prime Minister's Department • Ministry of Science, Technology and Innovation • Ministry of Natural Resources and Environment	• Meteorological Department • Mineral and Geoscience Department	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Mineral and Geoscience Department Malaysia • Meteorological Department • Sabah Chief Minister's Department • State Security Council • National Earthquake Monitoring Centre • National Disaster Management Agency
Implementing Agency		
• National Security Council		

SR2.3: Managing Development Growth and Sprawl

Malaysia's development pattern in the 1980s was one of concentrated development. There was no overflow of physical development in that period because the country's development then was focused on the agriculture and mining sectors. However, the economic downturn in 1985 led to a focus on manufacturing-based development, resulting in the migration of rural people to the cities. The resulting surge in the urban population led to increased demand for basic needs such as housing, community facilities and work spaces. These changes in economic development led to development sprawl, with urban fringes turned into residential, commercial and industrial areas and two adjoining towns merging to become one, each losing its unique features and identity in the process. Rural villages in the urban fringes have also been squeezed in by the rapid urban development. Measures to control urban sprawl should be integrated into the development and land-use control strategy at the state and local levels.

Action SR2.3A

Establishing urban growth limits

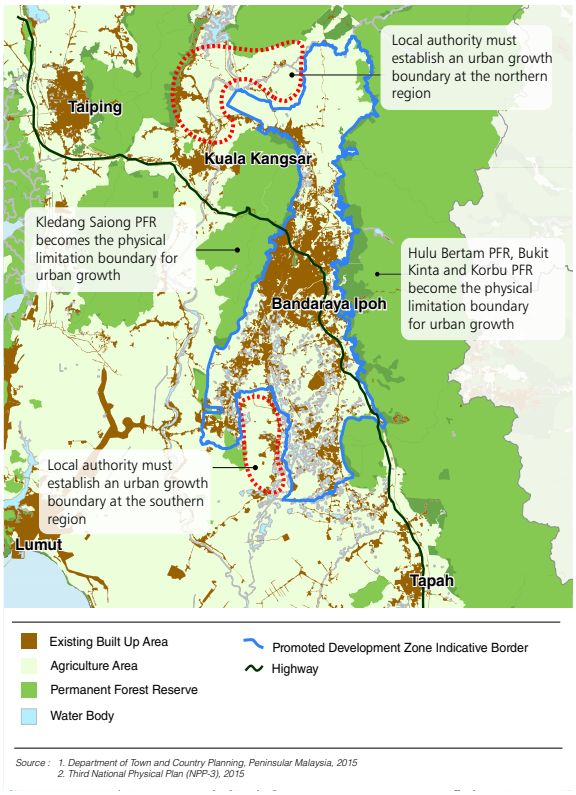
Physical limits to urban growth should be established for every city in order to achieve the sustainable and low-carbon city goal while retaining agricultural land and conserving the natural environment. Urban boundaries may also help in distinguishing urban from rural areas besides controlling unplanned development in agricultural and environmentally sensitive areas. State Governments and Local Authorities should set limits to urban growth in the state and district development plans. The Second National Urban Policy outlines two methods of mapping boundaries, namely Urban Growth Boundary (UGB) and Urban Containment Boundary (UCB), and aims to:

- Maximise the use of infrastructure facilities and reduce the cost of new infrastructure;
- Enhance the function of the city centre and existing towns; and
- Improve urban services

Another method of strengthening urban borders is establishing green belts or buffer zones, which should be identified by State Governments and Local Authorities in the effort to limit urban sprawl.

Box 4.24 - Urban Growth Boundaries

Forests, rivers and natural areas form suitable physical limits to urban growth, in line with the green belt concept. Other physical features, such as roads, highways, railways and agricultural and rural areas can also be used to delineate urban growth boundaries.



Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• State Governments	• Town and Country Planning Department of Peninsular Malaysia • State Governments	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Local Authorities		

SR2.4: Managing Integrated Rural Development

Some 35.3% of the population live in rural areas, which comprise built-up areas outside urban boundaries and cover 5.4% of the peninsula's total area. The rural-urban migration rate in the peninsula decreased from 8.7% in 2010 to 8.4% in 2014, highlighting the crucial importance of more effective and efficient rural land-use planning.

One of the rural transformation strategies under the 11MP is to strengthen economic activities by improving employment, productivity and income opportunities for rural residents. With the establishment of this initiative, the NPP-3 targets to maintain the rural population while improving their quality of life and resiliency.

Development of rural areas should be guided by the policies and recommendations in the National Rural Physical Planning Policy, which is a framework for integrated rural development to ensure that rural communities enjoy higher income and a better quality of life. The NPP-3 also emphasises on rural economic development in the effort to reduce the rural-urban gap. Strategic Direction SR2 focuses on this objective.

Rural-urban migration rate

Source: Department of Statistics, 2010 and 2014

Percentage of Rural Population in Sabah

Source: Department of Statistics Malaysia, 2000 and 2010

Action SR2.4A

Preserving rural identity and character through environment

Rural areas have a variety of important resources and environmental assets that should be preserved. Rural areas, with their quiet and peaceful surroundings, also offer a better quality of life than urban areas. The areas identity and character, reflected in their cultural, heritage and agricultural activities as well as landscape, should be preserved to ensure that rural development is aligned with the urban economy. Measures that could be implemented include:

1. Identify the rural areas with the potential to be preserved at the Local Plan and Special Area Plan levels;
2. Identify the functions, hierarchy and future development zones in rural areas that warrant preservation; and
3. Prepare guidelines for land use planning for the fringes between urban and rural areas, to provide guidance on permitted land use activities, density, building design and landscaping.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• State Governments	• Town and Country Planning Department of Peninsular Malaysia • Ministry of Rural and Regional Development	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities • Sabah Ministry of Rural Development
Implementing Agency		
• Local Authorities		

Action SR2.4B

Promoting and preserving rural areas with potential to be developed as tourist areas

Natural resources such as agricultural areas, national parks, mangroves and forest reserves as well as rural culture and heritage have potential to be developed for tourism. Such areas need to be preserved because they can help boost rural development and indirectly create a special rural character. One measure that could be implemented is the creation of rural settlements using the homestay concept.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Tourism and Culture Malaysia • Ministry of Rural and Regional Development	• State Governments • Local Authorities	• Sabah Ministry of Tourism, Culture and Environment • Sabah Ministry of Housing and Local Government • Sabah Ministry of Rural Development • Sabah Department of Town and Regional Planning • Sabah Tourism Board • Local Authorities
Implementing Agency		
• Local Authorities		

A village in Kuala Terengganu

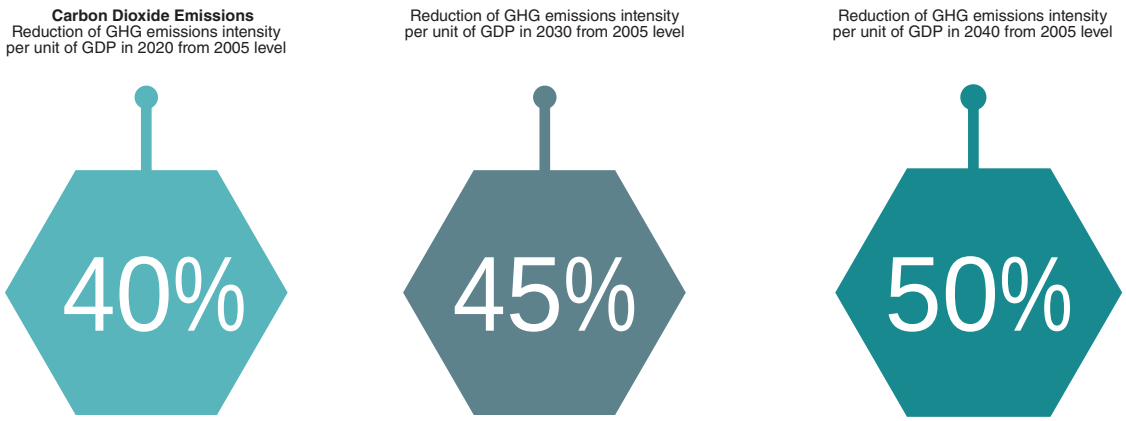
SR3

Low Carbon Cities and Sustainable Infrastructure

Addressing the effects of climate change through the reduction of greenhouse gases with the use of sustainable infrastructure and development of low-carbon cities

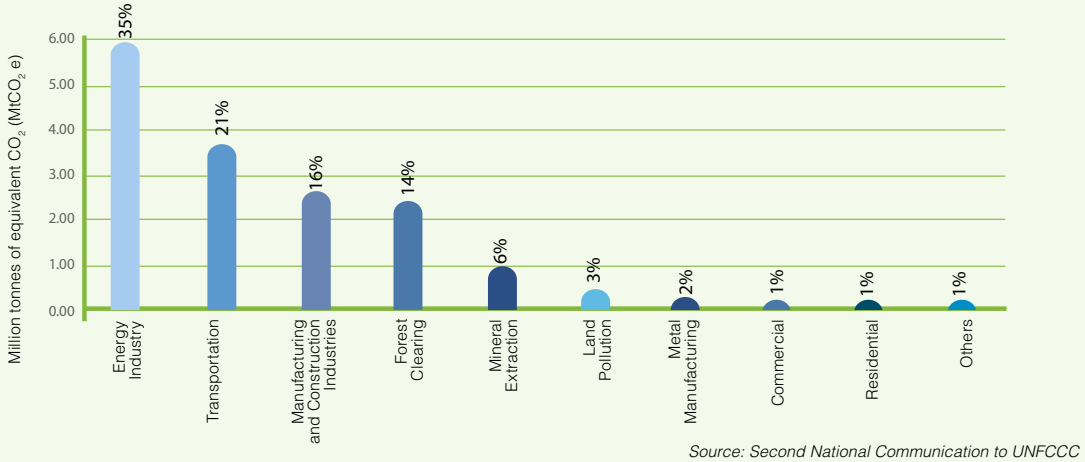
Green and low-carbon urban development will help the country achieve its commitment to reduce greenhouse gas emissions that contribute to global climate change. The country is committed to reduce its carbon emissions intensity by 40% per unit of GDP by 2020 from the 2005 level, and by 45% by 2030, while the NPP-3 has set a target of a 50% reduction by 2040.

Figure 4.34 Reduction of Greenhouse Gas Emissions Targets

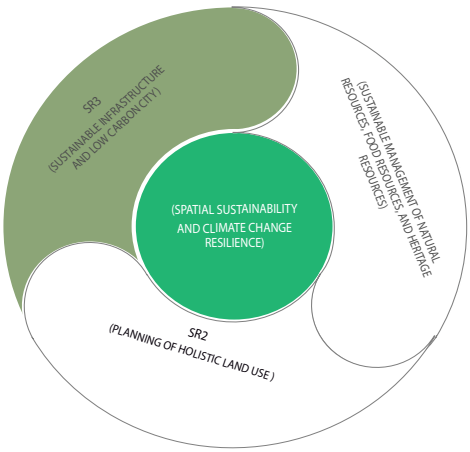


Source: 11th Malaysia Plan, 2015

Box 4.25 Main Sources of CO_2 emissions in Malaysia



Source: Second National Communication to UNFCCC



STRATEGIC DIRECTION SR3 LOW CARBON CITY AND SUSTAINABLE INFRASTRUCTURE

Infrastructure and transportation are the two main components of the urbanisation process, and it is crucial that they are sustainable, low carbon and green in the future. This includes the preparation and use of sustainable energy sources from renewable sources, and integrated water supply. A more holistic public transport system can also help change the patterns and mode of travel, especially for urban residents.

Improved services that are more efficient and effective could attract more intensive use, while a more sustainable solid waste management system should emphasise the need to reduce the quantity of waste and promote more recycling. Smart green technologies and infrastructures need to be applied in support of sustainable development and low carbon aspirations.

SR3.1 Creating Low Carbon Cities

SR3.2 Promoting Use of Sustainable Energy Sources

SR3.3 Implementing Integrated Water Cycle Management

SR3.4 Promoting Green Mobility

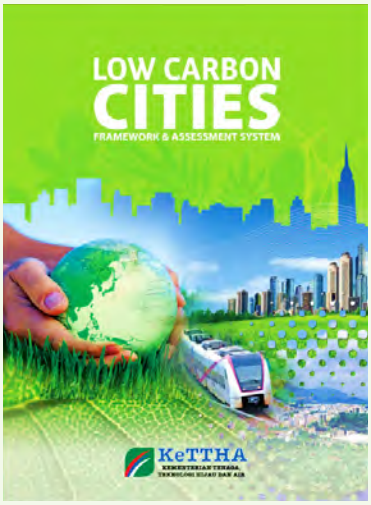
SR3.5 Strengthening Integrated and Sustainable Solid Waste Management

Proposed Tianjin Eco City Development
http://www.tianjinecocity.gov.sg/

SR3.1: Promoting Low Carbon City Development

With Urbanisation rate expected to continue to rise and urban activities being the main contributor to greenhouse gases, it is crucial that all urban areas and new developments introduce low-carbon city initiatives. In the effort to achieve the nation's overall greenhouse gas emissions reduction targets, policies and guidelines have been prepared by the Federal Government in the form of the Green Technology Policy, the Low Carbon Cities Framework (LCCF), and Guidelines for a Green Neighbourhood. In addition, there are several systems to measure the qualitative and quantitative performance of low-carbon actions for cities and developments.

Box 4.26 Low Carbon Cities Framework (LCCF)



The Low Carbon Cities Framework (LCCF) measures the real impact of development on the environment In terms of total carbon emissions.

This framework will demonstrate the impact of human activities on cities in the form of 'carbon equivalent' to create awareness on how the level of carbon emissions can be reduced.

The four main elements of the LCCF are:

1. Urban Environment
2. Urban Transport
3. Urban Infrastructure
4. Buildings

Source: Low Carbon Cities Framework and Assessment System

Box 4.27 Green Rating Systems in Malaysia

Green rating systems adopted in the country include:

1. Malaysia Carbon Reduction and Environmental Sustainability Tools (My CREST) by the Construction Industry Development Board Malaysia

1. Green Performance Assessment System in Construction (Green PASS) by the Construction Industry Development Board Malaysia

1. Green Building Index (GBI) by Greenbuildingindex Sdn Bhd.

Action SR3.1A
Providing Action Plan for Low Carbon Built Environment

A low-carbon city action plan requires a comprehensive approach and the involvement of various stakeholders in its formulation and implementation. The LCCF, prepared by the Ministry of Energy, Green Technology and Water, provides guidance in the formulation of low-carbon city strategies and implementation plans. The Green Neighbourhood Guidelines by the Department of Town and Country Planning Peninsular Malaysia can guide the design and development of a low-carbon or green neighbourhood. Carbon dioxide reduction can be measured using the rating system provided with the LCCF, the LCCF track, which is also produced by the Ministry of Energy, Green Technology and Water. The LCCF should also be adopted by Local Authorities as one of the main conditions for planning permission approval, initially on a voluntary basis and later becoming mandatory for Local Authorities.

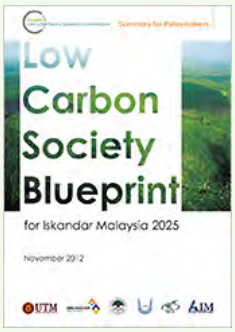
Figure 4.35 Steps in the Preparation of Low Carbon City Action Plan by Local Authorities

Source: Adapted from Low Carbon Cities Framework and Assessment System

Box 4.28 Example of Action Plan for Low Carbon Cities/Communities

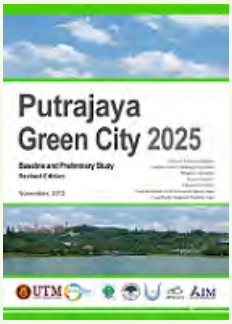
1. Iskandar Malaysia Low Carbon Society Blueprint

   Turning Iskandar Malaysia into a sustainable metropolis with the implementation of a green growth strategy



2. Putrajaya Green City in 2025

   The three main components are:
   - Low Carbon Putrajaya
   - Cooler Putrajaya
   - 3R Putrajaya



Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Energy, Green Technology and Water	• Town and Country Planning Department of Peninsular Malaysia • Malaysian Green Technology Corporation • Sustainable Energy Development Authority of Malaysia • Educational Institutions • Non-governmental organisations	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Department of Environment • Local Authorities
Implementing Agency		
• Local Authorities		

Action SR3.1B

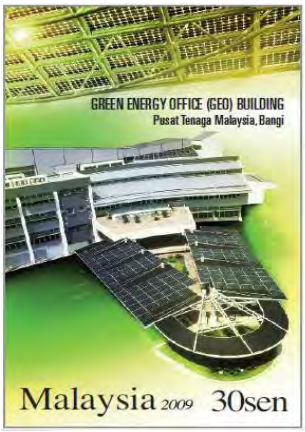
Promoting sustainable building practices

Sustainable building practices will help to achieve the goal of creating a low-carbon city. The main steps that need to be taken are:

a. Encourage green building design for new developments;
b. Require compliance with the Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings (MS1525: 2014);
c. Require mandatory use of Rainwater Harvesting System (RHS) for new buildings; and
d. Upgrade existing buildings to promote energy and water savings, especially for government buildings and public facilities such as mosques, schools, public educational institutions and government offices.

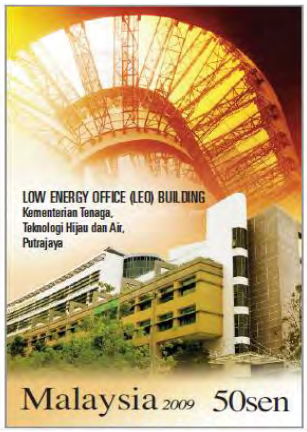
Figure 4.36 Low Carbon Buildings by Government of Malaysia

1. Malaysia Energy Centre Bangi



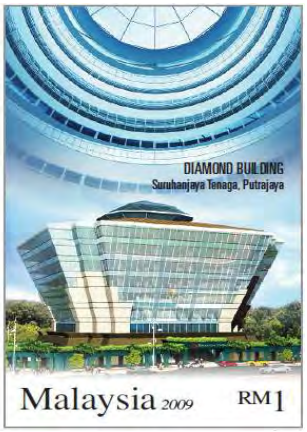
- Net Building Energy Index = 30 (86% reduction)
- 65 tons of CO2/year
- GBI: Confirmed (2009)
- ASEAN Energy Awards: 2009/2010/2011

2. Ministry of Energy, Green Technology and Water, Putrajaya



- Net Building Energy Index = 114 (59% reduction)
- 1,490 tons of CO2/year
- GBI: Silver (2011)
- ASEAN Energy Award: 2006

3. Energy Commission, Putrajaya



- Net Building Energy Index = 63 (70% reduction)
- 637 tons of CO2/year
- GBI and Green Mark: Platinum (2011)
- ASEAN Energy Award: 2012

Source: Sustainable Energy Development Authority of Malaysia

Box 4.29 Example of Community Facility with Green Building certification - Ara Damansara Mosque

The Ara Damansara mosque was developed by Sime Darby Property on 6 acres of land in Ara Damansara. It is the first mosque in Malaysia to achieve the Green Building Index (GBI) Gold status, and features rainwater harvesting, wastewater recycling and natural ventilation, obviating the need for air conditioning.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Energy, Green Technology and Water	• Town and Country Planning Department of Peninsular Malaysia • Malaysian Green Technology Corporation • Sustainable Energy Development Authority of Malaysia	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Department of Environment • Local Authorities
Implementing Agency		
• Building Owners • Local Authorities		

Action SR3.1C
Applying carbon sequestration principle through landscaping

The process of carbon uptake by plants occurs through the natural process of photosynthesis. The carbon that is absorbed is stored in the leaves, stems and other parts for the plant's growth. Some of the absorbed carbon is also stored underground through the transfer of carbon by the plant's roots.
This natural process can help minimise greenhouse gas on the earth's surface, helping to reduce the effects of climate change.

Measures to use plants as a greenhouse gas reduction agent in the country include:

a. Conducting a study on the carbon absorption rate by landscape trees;
b. Establishing guidelines on the selection of landscape trees by Local Authorities and developers; and
c. Emphasising the value of carbon sequestration, besides aesthetic value, in Local Authorities' choice of landscape trees.

Box 4.30 CO_2 Absorption Rate by Species

Trees with very high CO_2 absorption rate

Ficus benjamina
535.90 kg CO_2/tree/year

rachylobium verrucossum
562.09 kg CO_2/tree/year

Dialium excelsum
720.49 kg CO_2/tree/year

Trees with high CO_2 absorption rate

Lagerstroemia speciosa
160.14 kg CO_2/tree/year

Swietenia mahogany
295.73 kg CO_2/tree/year

Pometia pinnata
329.76 kg CO_2/tree/year

Source: Endes N. Dahlan

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Energy, Green Technology and Water • Ministry of Housing and Local Government	• Town and Country Planning Department of Peninsular Malaysia • Non-governmental organisations	• Ministry of Local Government and Housing Minister • Department of Town and Regional State • Environmental Department • Local Authorities
Implementing Agency		
• National Landscape Department • Local Authorities • Building Owners		

SR3.2: Realising the Use of Sustainable Energy Sources

According to the 11MP, the fuel mix for the electricity generation sub-sector is still too dependent on fossil fuel sources, amounting to 92.6% in 2006, 92.4% in 2011 and 90.6% in 2013.
Natural gas, the main fuel used (besides coal), is highly subsidised as it is the cheapest fuel for electricity generation. The nation's dependence on fossil fuels, however, will complicate efforts to reduce greenhouse gas emissions.

Therefore, emphasis should be on sustainable and renewable energy sources such as solar energy, hydropower, biomass, and wind energy. Renewable Energy (RE) sources should be developed in stages to reduce the country's dependence on fossil fuels and help the country reduce greenhouse gas emissions in the future through the generation of clean energy. RE development will be intensified with a focus on exploring new RE sources.

Box 4.31 Renewable Energy (RE)

In 2010, the country's reserve margin for power was 40%, but with the projected demand and development of power plants, the government plans to achieve a margin of around 20% by 2040.

Installed Generation Capacity, Current Demand and Current Energy Capacity, 2013

Region	Installed Generation Capacity (MWJ)	Current Demand (MW)	Current Capacity (MW)
Peninsular Malaysia	24,460.17	16,562	7,898.17
Sabah	2,020.15	874.4	1,145.75

Energy Demand Forecast

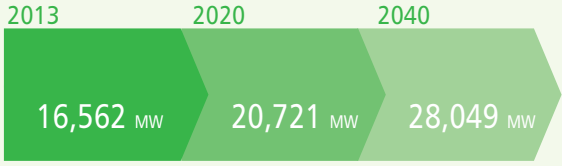
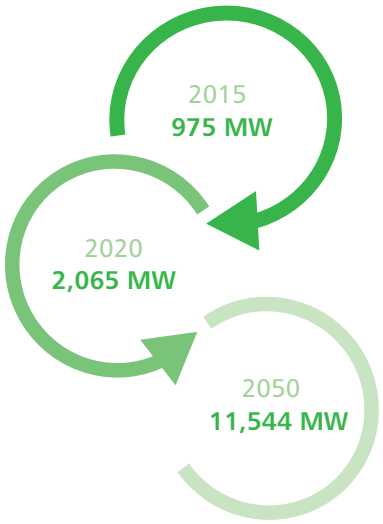


Figure 4.38 Renewable Energy (RE) Production Targets



Source: Policy and Action Plan for Renewable Energy, Ministry of Energy, Green Technology and Water

The Renewable Energy Act came into force in 2011 to raise the contribution of green energy such as solar photovoltaic (PV), biomass, biogas and mini hydro in the electricity generation mix in Malaysia. Implementation of the Feed in Tariff (FiT) system through this Act has increased the installed capacity of renewable energy five-fold to 243 MW in the period from 2009 to 2014. As of 2013, this initiative has reduced GHG emissions by 432,000 tonnes of carbon dioxide equivalent (tCO2eq).

Under the Ministry of Energy, Green Technology and Water's Renewable Energy Policy and Action Plan, through the enforcement of the Renewable Energy Act and the FiT scheme assisted by the Renewable Energy Fund introduced in this document, a total of 2,065 MW of renewable energy will be produced in 2020. In 2050, a total of 11,544 MW of renewable energy is expected to be generated, which in turn can reduce GHG emissions by 16,114,871 tonnes of CO2 per year.

Action SR3.2A
Promoting biogas and biomass energy development in plantations

There are many potential sources of biomass for energy generation such as agricultural waste and municipal waste. The palm oil industry is potentially a major source of Renewable Energy (RE) through more efficient and effective reuse of palm biomass solid waste to produce value added products.

The National Biofuel Policy was launched in 2006 to encourage the use of environmentally friendly, sustainable and viable biomass energy. Under the Five-Fuel Diversification Policy 2000, the Malaysian government has identified biomass as a potential renewable energy source. Malaysia produces at least 168 million tonnes of biomass, including wood and palm oil waste, rice husks, coconut trunk fibre, municipal waste and sugar cane waste per year. As a major agricultural commodity producer in the region, Malaysia is well positioned among the ASEAN countries to promote the use of biomass as a renewable energy source.

Accordingly, the use and generation of biogas and biomass energy resources from solid waste and agricultural waste will continue to be encouraged to support the transition to renewable energy. The further development of renewable energy, especially for local consumption, will continue to be encouraged.

Table 4.8 Agricultural Areas with Biomass Potential

State	Type of Agriculture	
	Rice cultivation (in rice bowls)	Palm Oil cultivation
Perlis	√	√
Kedah	√	√
Pulau Pinang	√	√
Perak	√	√
Kelantan	√	√
Terengganu	√	√
Pahang	√	√
Selangor	√	√
Negeri Sembilan	-	√
Melaka	-	√
Johor	-	√
Sabah	√	√

Source: Third National Physical Plan (NPP-3)

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Agriculture and Agro-based Industry • Ministry of Energy, Green Technology and Water	• Malaysian Green Technology Corporation • FELDA • FELCRA • KETENGAH • KEDA • KEJORA • Department of Environment Malaysia	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Department of Environment • Local Authorities
Implementing Agency		
• Sustainable Energy Development Authority Malaysia		

Action SR3.2B
Promoting development of environmentally friendly solar energy

Solar energy is another renewable energy source that is abundant and readily available because of Malaysia's location on the equator, and has high potential to become a source of alternative energy for the country.

However, the development of solar energy should be regulated, especially in relation to the clearing of forests. Solar farms require large expanses of land, potentially disrupting ecosystems and contributing to increased greenhouse gas emissions. The farms should preferably be located in existing areas that cannot be otherwise developed. An environmental impact assessment (EIA) should be prepared for the development of solar farms in environmentally sensitive areas as set out in the NPP-3, and for activities outlined in Schedules 1 and 2 of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.

Electricity for residential or commercial buildings currently comes mostly from oil-powered power plants. Installation of solar panels on industrial, commercial and residential buildings as well as public facilities should be expanded in order to reduce the demand for fossil fuels.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Agriculture and Agro-based Industry • Ministry of Energy, Green Technology and Water	• Town and Country Planning Department of Peninsular Malaysia • Malaysian Green Technology Corporation • Local Authorities	• Sabah Ministry of Infrastructure Development • Sabah Electricity Sdn Bhd • Local Authorities •
Implementing Agency		
• Sustainable Energy Development Authority Malaysia		

Box 4.32 Solar Development Project in Rural Area in Sabah

Through the Sabah Women Entrepreneurs and Professionals Association (Swepa), Tarihing Binti Masanim, a Dusun grandmother from the village of Kg. Sonsongan Magadai, Kota Kinabalu was selected for the Barefoot Solar Project.

She attended a six-month training course on developing small-scale solar power systems at the Barefoot College, India.

Upon completion of the course, Tarihing began developing a solar energy system in her village with the help of fellow villagers and funds from a non-governmental organisation, and on 15th August, 2015, the project was successfully completed.

Source: Sabah Women Entrepreneurs and Professionals Association

FIGURE 4.39 PENINSULAR MALAYSIA DAILY AVERAGE SOLAR RADIATION

The higher the radiation level at a particular area, the more suitable it is for solar energy development.

Solar Radiation Level (MJ/m^2)

- 14
- 16
- 18
- 20
- 22
- 24
- Main Centre

Source : Mekhielefa et al., 2012

Action SR3.2C
Promoting use of micro-hydro power for remote and interior areas

Micro-hydro power is a reliable, clean and environmentally friendly renewable energy source available to the public, and promotes forest and biodiversity preservation. This system can generate up to 100 kW of electricity, enough to meet the lighting, cooling, washing and cooking needs of 200 homes.

Such a community-based system in a rural and remote area is seen as a cost-effective method of supplying energy that could also contribute to a reduction in greenhouse gas emissions. Some of the country's rural residents, particularly indigenous communities in Peninsular Malaysia, Sarawak and Sabah, do not receive grid-based electricity but instead depend on diesel-powered generators for their electricity.

As micro-hydro facilities are in remote and isolated locations, they should preferably be owned by the local residents, who, after the facility is developed through a government allocation, should be given the necessary training to enable them to manage and operate the micro-hydro system by themselves.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Energy, Green Technology and Water	• Malaysian Green Technology Corporation	• Sabah Ministry of Infrastructure Development • Sabah Ministry of Rural Development • Sabah Electricity Sdn Bhd
Implementing Agency		
• Sustainable Energy Development Authority Malaysia		

Action SR3.2D
Promoting use of wind and other renewable energy sources

The suitability of wind energy that turns a turbine to generate electricity depends on the wind speed at the location, with the optimum average wind speed being 6.9 metres/second. In Malaysia, studies on the potential of wind power carried out since the early 1990s show that the potential for wind power in the country is limited as it is located near the equator where the average wind speed is below 3 metres/second.

However, the use of wind turbines in coastal areas on the East Coast of Peninsular Malaysia and Sabah as well as on the islands has potential, as their average wind speed throughout the year is around 5 metres/second. In addition, the use of wind turbines on islands is more effective as conventional electricity generation using diesel is expensive and environmentally unfriendly. Studies should be extended to other alternative sources like geothermal-based sources, nuclear energy and so on.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Energy, Green Technology and Water	• Town and Country Planning Department of Peninsular Malaysia • Malaysian Green Technology Corporation • Local Authorities	• Sabah Ministry of Infrastructure Development • Sabah Ministry of Rural Development • Sabah Electricity Sdn Bhd
Implementing Agency		
• Sustainable Energy Development Authority Malaysia		

FIGURE 4.40 PENINSULAR MALAYSIA RENEWABLE ENERGY STATION

Renewable Energy Station
- Gas Station
- Biomass Station
- Mini Hydro Station

River

Palm Oil Area

Source : Sustainable Energy Development Authority (SEDA)

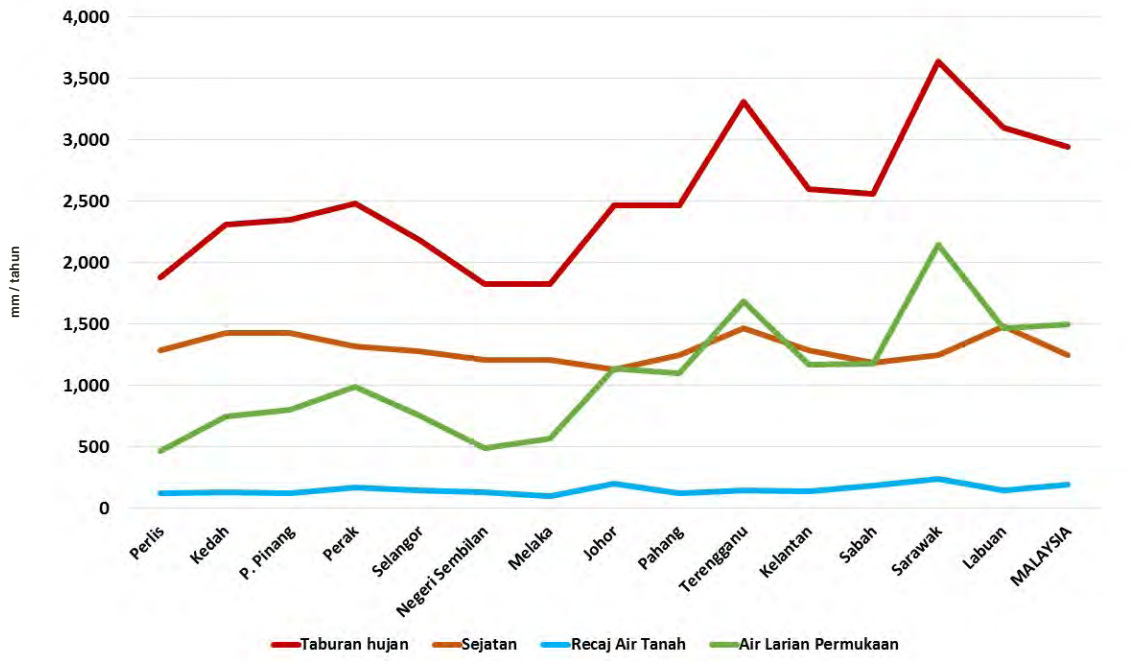
SR3.3: Implementing Integrated Water Cycle Management

Demand for water in Malaysia is expected to increase by 1.2% per year to reach 23,750 million litres per day in 2040 compared to 8.947 million litres per day in 2010. To ensure sufficient water supply for the next four decades, the capital expenditure is expected to hit RM4 billion. The NPP-3 highlights a number of actions to implement integrated water cycle management to ensure water security in the future. The National Water Resources Policy states that water resources should be viewed from three main perspectives -- water as a dynamic source, the activities related to water resources, and the impact on water resources.

The water supply is currently obtained from upstream areas, with rivers contributing 30% and the remainder from water flowing into the sea. This means that water resources in the country depend on the amount of rainfall in the country. Several studies have been conducted to identify the impact of climate change on changes in rainfall patterns and river flows. Studies conducted in the Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC) also expect indicative changes in the rainfall pattern projections for Peninsular Malaysia, Sabah and Sarawak in 2050. Changes in rainfall patterns in the country are also expected to have an impact on the country's water resources, which in turn are also affected by factors such as pollution and non-revenue water.

The United Nations Environment Programme (UNEP) defines integrated water cycle management as a process that promotes the coordination of the development and management of water, land and other related resources, to maximise economic and social welfare in an equitable manner without compromising the sustainability of important ecosystems. Surface water is the country's main water source, followed by groundwater and alternative water sources such as rainwater harvesting and water reuse. Therefore, any water resource planning should take into account the distribution of rain water to prevent water scarcity, as the amount of surface water depends on rain water. To safeguard the country's future water security, several actions are outlined in the NPP-3.

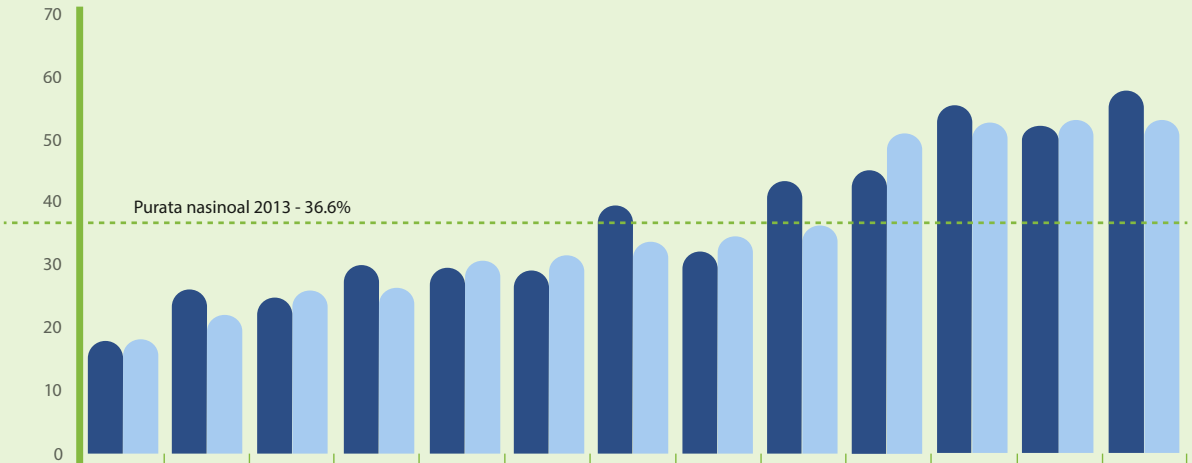
Figure 4.41 Rainfall Distribution in Malaysia 2011



Source: National Water Resources Study (NWRS) 2000-2050

Box 4.33 Water Supply

Non-Revenue Water (NRW), 2010 and 2013



	Pulau Pinang	Melaka	WP Labuan	Johor	Perak	Sarawak	Terengganu	Selangor	N. Sembilan	Kedah	Pahang	Kelantan	Sabah
2010	18.2	26	24.9	29.9	29.4	29	39.4	32.4	43.4	44.9	55.3	52.4	57.4
2013	18.2	22.1	25.9	26.4	30.4	31.3	33.8	34.5	36.3	50.9	52.7	53.1	53.2

Source: National Water Services Commission

Projected Changes in Rainfall Distribution Due to Increased Temperatures In 2050

Peninsular Malaysia:

- North-east region projected to get up to 9% higher average annual rainfall.
- Central region projected to get the highest annual average rainfall decrease of 5%.
- North-east region expected to experience greatest increase in maximum monthly rainfall of 50%.

Sabah and Sarawak:

- Eastern part of Sabah projected to get about 6% lower average annual rainfall.
- Western part of Sabah projected to get about 2% higher average annual rainfall.
- Eastern part of Sarawak projected to get increase in annual average rainfall of about 5%.
- Annual rainfall in western part of Sarawak expected to increase by about 11%.

Source: Second National Communication to the UNFCCC

Action SR3.3A
Providing sustainable water supply

Source of surface water and increasing demand for water in the future could cause water supply disruptions in the country if the problem is not given due attention. It is the need of the country to develop alternative water supply system to overcome water scarcity problem in the future. Research on alternative water sources should be conducted, taking into account the following factors:

1. Downstream water intake

Guidelines on the use of water in downstream areas should be formulated so as to optimise the management of water supply. The construction cost of a treatment plant in this area is high, but this can be reduced by ensuring that pollution from industrial sources, development projects, sewage treatment plants, solid waste disposal sites and so on comply with existing legal requirements. Most of the downstream regions have larger water volumes. A water treatment plant could be built in the downstream part of the following rivers:

a. Sungai Kedah;
b. Sungai Perak;
c. Sungai Batu Pahat;
d. Sungai Johor;
e. Sungai Kinabatangan; and
f. Sungai Tuaran.

2. Abstraction of groundwater

Groundwater is usable for use by industrial sectors that need a lot of water. Among the states, groundwater use is highest in Kelantan. Detailed guidelines should be provided by the Department of Mineral and Geoscience to prevent the use of contaminated groundwater. These guidelines would ensure that the rate of groundwater extraction does not exceed the groundwater capacity so as to prevent disasters such as sinkholes.

3. Desalination of sea water

A range of innovations could reduce the cost of seawater desalination, including the construction of a solar-powered water desalination plant, which is seen as a lower-cost alternative to the conventional oil-powered plant and having the potential to supply water to the country's coastal regions and islands.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Energy, Green Technology and Water • Ministry of Natural Resources and Environment	• National Water Services Commission • Department of Environment • Department of Irrigation and Drainage	• Sabah Ministry of Infrastructure Development • Sabah Water Department • Department of Environment
Implementing Agency		
• Mineral and Geoscience Department • State Governments		

Action SR3.3B
Implementing water reuse

The implementation of water reuse in urban, industrial and agricultural activities needs to be enhanced as a key action to manage the water cycle in an integrated and sustainable manner. This includes several actions as follows:

1. Expanding use of rainwater harvesting system

Reuse of rain water for domestic, commercial, industrial and agricultural activities could reduce demand for treated water and solve water supply problems, thus preserving water resources and reducing the climate change impact. Since the Rainwater Harvesting System's (RHS) introduction in Malaysia in 1999, its use has become a development requirement with amendments to the Uniform Building By-laws 1984 passed at the 64th meeting of the National Council for Local Government. To date, eight states have gazetted the RHS.

However, comprehensive and effective RHS implementation is still not possible due to various constraints at the Local Authorities level. These include the difficulty to monitor installations especially in the issuance of Certificates of Completion and compliance by architects and professional engineers. The challenge is ensuring effective design that does not encourage the breeding of Aedes mosquitoes.

To ensure more effective implementation, these constraints need to be addressed in a comprehensive and holistic manner. Amendments to the Uniform Building By-laws 1984 should be passed in more states, while at the Local Authority level, compliance to the guidelines related to the system of rainwater collection and reuse should be tightened by the Ministry of Urban Wellbeing, Housing and Local Government.

Table 4.9 States in Malaysia that have gazetted Rainwater Harvesting System

State	Gazette date	Cazette No.
Perak	2 February 2012	Pk.P.U.5
Selangor	22 March 2012	Sel.P.U.40
Johor	29 March 2012	J.P.U.17
Kelantan	5 July 2012	Kn.P.U.15
Melaka	5 July 2012	M.P.U.27

Source: Public Utilities Board (PUB), Singapore

Box 4.34 Example of Rainwater Harvesting System

The Forest Research Institute Malaysia (FRIM) launched the Rain Water Harvesting System (RWHS) at its Auditorium (Block E1) in September 2015. The system was aimed at reducing water consumption in line with the government's water saving campaign. The water is meant only for use in the bathroom and for watering trees around the building. The system is estimated to have reduced consumption of water supplied by SYABAS to the Auditorium by 15-20 cubic metres per month.

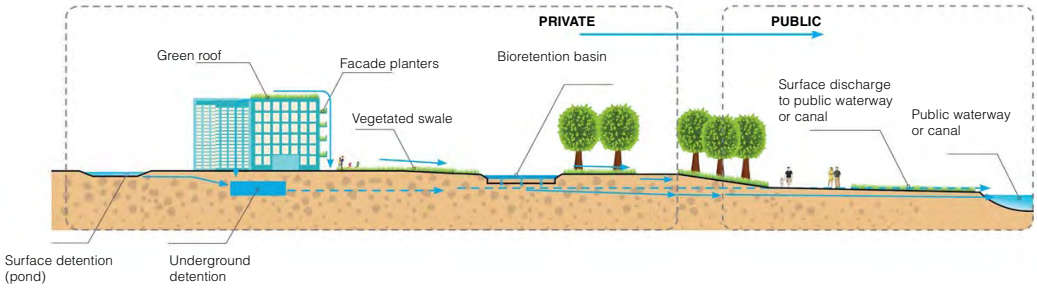
Source: Forest Research Institute Malaysia

2. Reuse of rain water surface runoff

Reuse of rain water surface runoff has the potential to grow due to economic and environmental factors. As of 2013, almost 9% of Peninsular Malaysia comprises built-up areas (in rural and urban areas). With the increase in population in the future, the need for built-up areas for economic, urban and other activities will continue to grow. This in turn will reduce the size of water-permeable areas and increase the amount of rain water runoff, especially in urban areas. As a consequence, water runoff must be managed comprehensively in order to avoid incidents such as flash floods and also to provide an alternative water source for urban areas. Reuse of rain water runoff can reduce the pressure on raw water resources by reducing the demand for treated water.

The use of guidelines such as the Environmentally Friendly Drainage Manual (EFDM) by the Department of Irrigation and Drainage Malaysia could assist Local Authorities in implementing the reuse of rain water

Box 4.35 – Design Features of ABC Water,



3. Reuse of sewage treatment plant bio effluent

Bio effluent refers to water effluent released from sewage treatment process that is later distributed to rivers/ water sources. However, after the bio effluent is treated, the composition of Biological Oxygen Demand (BOD) and Suspended Solid (SS) is lower than untreated raw water sources. As such, the proposed bio effluent reuse is suitable for watering of landscape, agricultural irrigation and industrial sector activities. At the moment, the production of treated effluent in Malaysia is at 4,500 million litres per day where 303 million litres per day is produced in Kuala Lumpur and Selangor, the industrial hubs of the country.

Sewage treatment plant bio effluent reuse will reduce the pressure on raw water sources, reducing demand of treated water for daily consumption not in need of clean water and for wider perspective; it can reduce the Greenhouse Gas (GHG) emissions.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Energy, Green Technology and Water	• National Water Services Commission • Malaysian Green Technology Corporation	• Sabah Ministry of Infrastructure Development • Sabah Water Department • Department of Environment • Local Authorities
Implementing Agency		
• State Governments • Local Authorities		

Action SR3.3C
Improving water quality

1. Adoptation of sustainable drainage systems

The sustainable urban drainage system (SUDS) concept takes into account environmental and social factors over the long term, using an approach that aims to maintain natural flow, infiltration and absorption into the ground, waste removal or filtration, and removal of pollutants by plants.

With the implementation of the EFDM, new development projects must ensure that the peak flow after development should be equal to or less than the flow before development (DID, 2000). This regulation, used in the United States, Australia and Japan, facilitates control of water at source to reduce the occurrence of flash floods, especially in urban areas.

A drainage system that can be used is the Bio-Ecological Drainage System (BIOECODS), an alternative storm water runoff management system that is environmentally friendly, sustainable and complies with the requirements related to the quantity and quality of storm water runoff as suggested by the Urban Storm Water Management Manual for Malaysia.

Box 4.36 Example of Bio-Ecological Drainage System at Universiti Sains Malaysia (USM)

BIOECODS was designed by the River Engineering and Urban Drainage Research Centre (REDAC) of Universiti Sains Malaysia, and is an alternative rain water runoff management system that is environmentally friendly and sustainable. The system's 320-acre area is intended to reduce the runoff flow rate, runoff volume and pollutant load through control measures at the source of the storm water runoff on campus.

Source: River Engineering and Urban Drainage Research Centre

2. Improving efficiency of wastewater treatment

The efficiency of wastewater treatment in the country must constantly be improved through the use of new technologies to ensure the waste water discharged adheres to the standards outlined in the guidelines that have been provided such as the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979.

Wastewater treatment technologies such as infiltration systems, biological sand filters, willow based evaporative systems and constructed wetlands, as used in a developed country like Denmark, could also be used in Malaysia. Modern technologies, such as membrane technology, can also be used to provide quality treated wastewater as adopted by Singapore to produce 'NEWater'.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government	• Department of Irrigation and Drainage • National Hydraulic Research Institute (NAHRIM) • Department of Environment Malaysia • National Water Services Commission	• Sabah Ministry of Infrastructure Development • Sabah Water Department • Department of Environment • Local Authorities
Implementing Agency		
• Local Authorities		

Action SR3.3D
Reducing water demand

Awareness of the constraints of water resources should be enhanced in the public. In Malaysia, there are states with very low and even zero water storage volume, which could harm their investment prospects. Alternative water sources should be identified in the event that water suppliers cannot meet the demand.

Implementation and monitoring responsibilities

Peninsular Malaysia and Labuan Federal Territory		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Energy, Green Technology and Water	• Local Authorities • Water companies • Water authorities	• Support Agency • Sabah Ministry of Infrastructure Development • Sabah Water Department • Local Authorities
Implementing Agency		
• State Governments • National Water Services Commission		

Table 4.9 Total Water Demand 2014-2015

State	2014					2015				
	Domestic		Non-Domestic		Total	Domestic		Non- Domestik		Total
	Milllion/ Day	%	Milllion/ Day	%	Milllion/ Day	Milllion/ Day	%	Milllion/ Day	%	Milllion/ Day
Johor	823	67.8	391	32.2	1,215	811	64.4	448	35.6	1,259
Kedah	510	73.2	187	26.8	697	511	72.8	191	27.2	702
Kelantan	154	68.3	71	31.7	225	159	68.6	73	31.4	231
Labuan	17	35.8	31	64.2	48	17	35.2	32	64.8	49
Melaka	196	52.1	180	47.6	376	202	52.0	186	48.0	388
N.Sembilan	259	54.4	217	45.6	476	276	55.9	217	44.1	493
Pulau Pinang	438	59.4	330	40.6	813	483	59.5	329	40.5	813
Pahang	303	58.4	216	41.6	520	309	58.2	223	41.8	532
Perak	623	72.5	236	27.5	858	628	71.5	250	28.5	878
Perlis	81	84.5	15	15.5	95	81	84.2	15	15.8	96
Sabah	330	57.1	248	42.9	577	315	57.1	237	42.9	552
Sarawak	469	57.9	341	42.1	810	478	56.5	368	43.5	846
Selangor	1,779	58.4	1,268	41.6	3,048	1,862	58.6	1,316	41.4	3,178
Terengganu	241	57.5	176	42.3	417	246	57.5	182	42.5	428
MALAYSIA	6,267	61.6	3,909	38.4	10,176	6,378	61.1	4,067	38.9	10,455

Source: National Water Services Commission

Table 4.10 Domestic Water Consumption, 2014

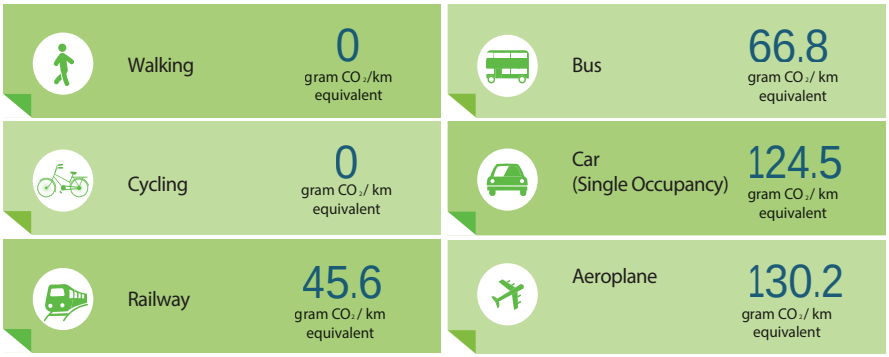
State	Litres/Capita/Day
Malaysia	211
Singapura	150
Jepun	375
United Kingdom	149
Amerika	575

Source: United Nations Development Programme

SR3.4: Promoting Low-Carbon Mobility

In line with the strategy of the 11MP, the NPP-3 emphasises on the development of infrastructure and services that support low-carbon mobility, with a focus on public transport with low carbon footprint, and the provision of comprehensive walking and cycling facilities especially in urban areas.

Figure 4.42 Carbon Footprint Comparison by Mode



Source: European Energy Agency

Action SR3.4A

Formulating Urban Public Transport Master Plan

Low-carbon mobility emphasises on the use of public transport to reduce road congestion, environmental pollution and dependence on private vehicles. Measures to promote low-carbon mobility include:

1. Widening catchment area of high capacity transit like the MRT and LRT to link major areas in the city;
2. Supporting creation of high-capacity transit network by providing local public transport modes like Bus Rapid Transit (BRT), trams and buses;
3. Increasing the use of energy-efficient public transport modes such as taxis and buses that use Compressed Natural Gas (CNG);
4. Providing a comprehensive Public Transport Master Plan for each city. Local Authorities should collaborate with the relevant agencies and State Governments in the preparation of this plan, which can be provided as part of the Development Plan (Local Plan) or separate from the Local Plan; and
5. Proposed large-scale developments by developers must integrate the proposed public transport network and facilities as part of the proposed development plan. Location of the main public transport stations should be identified in the proposed development.

Implementation and monitoring responsibilities

<table>
<tr><th colspan="2">Peninsular Malaysia and Labuan Federal Territory</th><th>Sabah</th></tr>
<tr><th>Monitoring Agency</th><th>Support Agency</th><th>Support Agency</th></tr>
<tr><td>• Ministry of Urban Wellbeing, Housing and Local Government
• Ministry of Transport</td><td rowspan="3">• State Governments</td><td rowspan="3">• Sabah Ministry of Infrastructure Development
• Sabah Ministry of Local Government and Housing
• Sabah Department of Town and Regional Planning
• Public Vehicle Licensing Board Sabah
• Local Authorities</td></tr>
<tr><th>Implementing Agency</th></tr>
<tr><td>• Town and Country Planning Department of Peninsular Malaysia Local Authorities
• Land Public Transport Commission
• State Governments</td></tr>
</table>

Action SR3.4B
Promoting use of low-carbon private vehicles in cities

Use of low-carbon private vehicles among the country's population can be enhanced through:

1. Provision of incentives to the public to promote the use of low-carbon vehicles in cities, such as hybrid cars and electric cars;
2. Provision of charging stations for electric vehicles in main city areas; and
3. Determining the parking needs of low-carbon vehicles in each development.

Box 4.37 Example of Low Carbon Vehicle Incentives

1. Petaling Jaya

Petaling Jaya City Council (MBPJ) has introduced a free parking incentive scheme open to all individuals or companies who purchase a hybrid car/electric vehicle from dealers in Petaling Jaya.

This scheme is only for first-time buyers of hybrid/electric cars and applies only to streets in Petaling Jaya.

2. Hang Tuah Jaya

The Hang Tuah Jaya Municipal Council (MPHTJ) provides the following incentives to encourage the use of electric and hybrid vehicles:

- charging stations;
- special parking lots for electric/hybrid vehicles;
- special stickers for such vehicles; and
- special parking rates for such vehicles.

Electric charging stations at Suria KLCC are an example of a green campaign initiative by the PETRONAS Group of Companies. Owners may charge their electric vehicle while it is parked.

Source: http://www.parking.klcc.com.my/

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Energy, Green Technology and Water • Town and Country Planning Department of Peninsular Malaysia	• Malaysian Green Technology Corporation	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Local Authorities • State Governments		

Action SR3.4C
Providing easily accessible pedestrian and bicycle facilities

A good and comprehensive urban pedestrian network, especially at the main nodes in the city such as the city centres, transit centres, employment centres, neighbourhood centres, service centres, tourist areas and higher education institutions, would minimise local travel by private vehicles. This would help to achieve the goal of increasing the use of public transport and promoting low-carbon mobility. The provision of pedestrian facilities that are continuous, sustainable, comprehensive, comfortable, safe, user-friendly and accessible should be a priority for every city and town in Malaysia. Each city or town should prepare a Pedestrian Network Master Plan to promote more holistic implementation and provision of facilities.

The bicycle route network should also be extended to serve as an alternative mode of movement, and not just for recreational purposes. Special bike lanes can be integrated with new road reserves provided by the relevant agencies, Local Authorities and developers. For existing roads, collaboration between the responsible parties should be intensified, particularly between Local Authorities and the Public Works Department.

Examples of bicycle lanes and pedestrian walkways



Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Town and Country Planning Department of Peninsular Malaysia	• Public Works Department	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Local Authorities • State Governments		

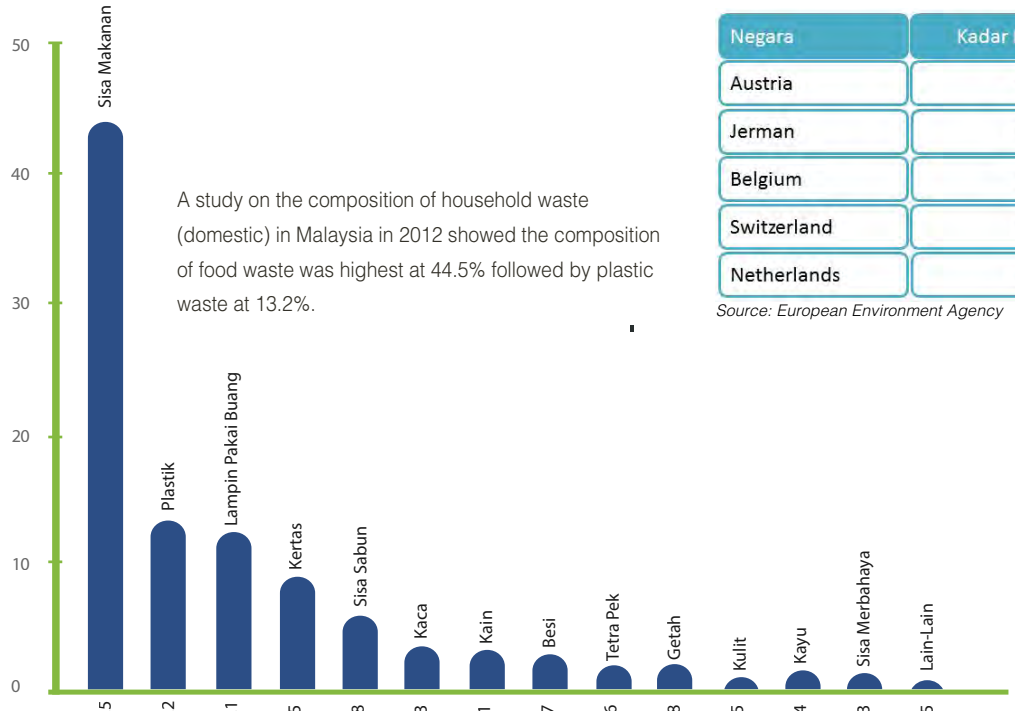
SR3.5: Strengthening Integrated and Sustainable Solid Waste Management

The Solid Waste and Public Cleansing Management's (SWCorp) strategic plan for 2014 to 2020 states that the increase in population, uplift in socio-economic status and lifestyle changes in society are the main factors contributing to the country's solid waste and waste composition changes. In 2012, Malaysia's domestic solid waste totalled 33,000 tonnes per day, an amount which surpassed the Japan International Cooperation Agency's (JICA) estimate of 30,000 tonnes per day by 2020. The amount of industrial and construction waste generated daily was 17,000 tonnes and 26,000 tonnes respectively. This is a key issue that needs to be dealt properly.

The strategic plan also states that the recycling rate in Malaysia still low at 10.5%, based on 2012 data. A variety of initiatives and programme have been implemented by the Government, but they have not been able to raise the recycling rate to a credible level. The recycling rate in Malaysia is much lower than in developed countries, and in fact is lower than some developing countries such as Thailand, where the rate was 22% in 2009.

Recycling rates in other Asian countries are also high, with Korea at 66% (in 2010); Singapore 61% (2013); and Taiwan 60% (2011). In addition, the recycling rates for plastics in developed countries like Japan have reached 77%, reflecting the huge efforts needed to be made by Malaysia to become a truly developed nation not only in economic and social terms but also in better environmental and solid waste management practices.

Figure 4.43 Solid Waste Household Waste Composition in Malaysia in 2012



Source: Household Waste Composition in Malaysia (2012), Survey on SW Composition, Characteristics and Existing Practices of SW Recycling in Malaysia, Final Report

Figure 4.43 Recycling Rates in Some European Countries

Negara	Kadar Kitar Semula
Austria	63%
Jerman	62%
Belgium	58%
Switzerland	51%
Netherlands	51%

Source: European Environment Agency

Action KD3.5A

Creating solid waste management facilities in line with social and low-carbon needs of urban areas

Solid waste management should be implemented in a comprehensive manner by providing facilities and technologies that meet the needs of a sustainable solid waste management cycle. This can be done through the following measures:

1. Providing a solid waste management facility in the neighbourhood

a. Provide household recycling centre and composting centre in each neighbourhood to facilitate separation and recycling.

b. Provide bulk waste recycling centre in strategic and controlled area in each urban service zone identified by the Local Authority. Electronic waste (e-waste) will be taken care of at this recycling centre.

2. Identify at solid waste treatment technologies that are effective, economical and environmentally friendly

In the treatment of solid waste, priority should be on minimising the disposal of solid waste at landfills through:

c. Strategic location of the treatment centre so that it is low-carbon and accepted by the local community;

d. Control amount of waste generated and types of waste that can be turned into products beneficial to the local community and sectors such as agriculture and energy. Landscape, sewage, agricultural and livestock waste should be treated with appropriate technology to reduce cost of waste treatment and turn the waste into value-added products;

e. Adopting technology that has been proven effective locally and abroad;

f. Develop pilot project of appropriate scale to demonstrate new technologies that are still at the R&D stage; and

g. Compliance with high environmental quality standards.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government	• Department of Environment Malaysia • Town and Country Planning Department of Peninsular Malaysia • Local Authorities	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Department of National Solid Waste Management • Solid Waste and Public Cleaning Management Corporation		

Recycling Centre at Precinct 9, Putrajaya

Action SR3.5B
Adopting municipal solid waste remediation

Remediation of municipal solid waste will produce many benefits to the economy and the environment, including employment and income opportunities, as well as reduction of greenhouse gas emissions and the need for landfills and waste incineration facilities.

1. Adopting Waste to Energy (WtE) technology

a. A waste to energy plant is a solid waste and public cleansing management approach that treats waste to produce energy such as electricity, heat and fuel for vehicles, reducing the amount of solid waste in landfills.

b. WtE plants are proposed for:
- Solid Waste Transfer Station, Taman Beringin, Kuala Lumpur;
- Bukit Payung, Johor; and
- Sungai Udang, Melaka.

2. Reprocessing and treatment of solid waste into new materials to promote green industry

a. Food waste turned to feed and manure for agriculture and aquaculture sectors;

b. Generating gas and electricity from organic and solid waste; and

c. Solid waste materials that can be reused or recycled which have a ready or future market.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government	• Town and Country Planning Department of Peninsular Malaysia • Concessionaires	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Department of National Solid Waste Management • Solid Waste and Public Cleansing Management Corporation		

Energy generation from landfill gas at Bukit Tagar Sanitary Landfill

Source: KUB-Berjaya Energy Sdn Bhd

Action SR3.5C
Enforcing laws related to solid waste management

The government made it mandatory for households to separate solid waste in phases by September 2015. Implementation is under the provisions of the Solid Waste and Public Cleansing Management Act 2007 (Act 672) which is only enforced in the federal territories of Kuala Lumpur and Putrajaya and the states of Pahang, Johor, Melaka, Negeri Sembilan, Perlis and Kedah. Measures that need to be taken include:

1. **Enforcing the Solid Waste Management and Public Cleansing Act (Act 672) in the relevant states**
   Enforcement of Act 672 should be in stages when the infrastructure is available and intensive public awareness programmes have been conducted.

2. **Revising existing laws on solid waste management for states not covered under Act 672**
   Revising laws related to waste separation at source as well as the necessary facilities should be included in state laws and Local Authority by-laws.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		Sabah
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government	• Solid Waste and Public Cleansing Management Corporation • Local Authorities	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• State Governments • Department of National Solid Waste Management		

Action SR3.5D
Implementing waste separation at source

Waste separation at source could lower the amount of solid waste sent to landfills and reduce the national cost of solid waste treatment. This can be done through:

1. **Creating awareness programmes in schools and communities**
   Programmes in pre-school, primary and secondary schools should be implemented to promote culture of waste separation at source, including on:
   a. Disseminating knowledge of types of waste that can be recycled;
   b. Providing recycling centres at strategic locations to facilitate recycling;
   c. Providing facilities for separation of food waste and recyclables especially in cafeteria;
   d. Providing waste separation facilities for garden waste for composting; and
   e. Holding awareness programmes periodically and monitoring their performance.

2. **Creating collection system in line with separation at source concept**
   Collection systems need to be adjusted in line with the concept of waste separation at source so that waste can be treated more effectively and economically. Separation of organic waste and recyclable materials should be implemented.

3. **Providing incentives for implementing segregation at source**
   Individuals or companies that carry out separation at source should be given incentives in various forms such as tax rebates to ensure continuity.

4. **Active involvement of mass media as information disseminators**
   The mass media can influence people to change their mind set and create a culture of waste separation, so their involvement is very important.

5. **Support of non-governmental and private agencies**
   Implementing waste segregation at source for industrial and commercial activities could reduce disposal costs and create opportunities for income generation and educate employees to minimise waste generation.

6. **Promoting E-waste Environmental Alliance Malaysia programme**
   Among the objectives of this programme are:
   a. Effective implementation of collection, sorting and transportation of household e-waste;
   b. Developing a system of collecting, sorting and transportation of household e-waste in Malaysia;
   c. Raising public awareness on reducing e-waste from households;
   d. Raising awareness among producers/sellers/distributors of electrical and electronics goods on the importance of responsible management of household e-waste;
   e. Encouraging producers/suppliers/distributors of electrical and electronics waste collection to implement household e-waste management voluntarily and at no additional charge; and
   f. Creating a network of cooperation with stakeholders in household e-waste management.

Implementation and monitoring responsibilities

Peninsular Malaysia and Federal Territory of Labuan		**Sabah**
Monitoring Agency	**Support Agency**	**Support Agency**
• Ministry of Urban Wellbeing, Housing and Local Government • Ministry of Natural Resources and Environment	• Town and Country Planning Department of Peninsular Malaysia • Local Authorities	• Sabah Ministry of Local Government and Housing • Sabah Department of Town and Regional Planning • Local Authorities
Implementing Agency		
• Department of National Solid Waste Management • Solid Waste and Public Cleansing Management Corporation • Department of Environment		

Implementation Indicators for Thrust 2

Overall, 15 strategies under Thrust 2 will be evaluated by the identified indicators, which are the main instrument used to monitor the effectiveness of spatial management in the effort to create a nation that is resilient to climate change. Data provided by the implementing and monitoring agencies to the Department of Town and Country Planning of Peninsular Malaysia will aid the monitoring process.

Strategy	Indicator
SUSTAINABLE MANAGEMENT OF NATURAL, FOOD AND HERITAGE RESOURCES	
SR1.1 Improving Preservation and Conservation of National Ecological Assets	• Areas gazetted or managed as protected areas. • Gazettement of granary areas/ rice bowls. • Number of granary areas with upgraded irrigation infrastructures.
SR1.2 Managing and Controlling Development in Environmentally Sensitive Areas (ESAs)	• Number of protected and gazetted ESAs in State Structure Plan (SSP).
SR1.3 Enhancing Security and Sustainability of Water Resources	• River basin management plans gazetted in the SSP. • River water quality safe for human consumption (Class IIB)
SR1.4 Managing Mineral Resource Exploration	• Environmental quality of areas surrounding/ nearby mining areas (to state the radius).
SR1.5 Promoting Food Security	• Increment in food commodity productivity and areas.
SR1.6 Strengthening Protection and Preservation of National Archaeological and Natural Heritage Sites	• Number of gazetted archaeological and natural heritage sites. • Number of gazetted conservation plans and Special Area Plans.
HOLISTIC LAND USE PLANNING	
SR2.1 Optimising Land Use and Land Availability	• Rate of agricultural land conversion to development. • Urban redevelopment rate. • Availability of urban transit plan.
SR2.3 Managing Development Growth and Sprawl	• Frequency and intensity of local natural disasters.
SR2.3 Managing Development Growth and Sprawl	• Urban growth rate. • Redevelopment plan for city centres and urban areas.
SR2.4 Managing Integrated Rural Development	• Rate of land use conversion from protected areas (forest and agriculture) to rural development activities.
LOW CARBON CITIES AND SUSTAINABLE INFRASTRUCTURE	
SR3.1 Creating Low Carbon Cities	• Number of cities/development areas/areas certified as low-carbon city
SR3.2 Promoting Use of Sustainable Energy Sources	• Number of renewable energy projects and capacity
SR3.3 Implementing Integrated Water Cycle Management	• Integrated Water Management Plan at state and local authority level. • Level of dependency on treated water sources. • Water consumption per capita.
SR3.4 Promoting Green Mobility	• Number of public transportation master plan. • Number of pedestrian and cycling lanes master plan. • Total length of pedestrian and cycling lanes.
SR3.5 Strengthening Integrated and Sustainable Solid Waste Management	• Reduction of solid waste at landfills.