

Environmental Quality Management Plan

2023 - 2027

(Abridged Edition)



Office of Natural Resources and Environmental Policy and Planning
Ministry of Natural Resources and Environment

Preface

The 20-year National Strategy of Thailand (2018 – 2037) aims to guide the country's development across various dimensions including "A Secure Nation, Contented People, Continued Economic Growth, An Equal Society, and Sustainable Natural Resources". In Strategic Direction 5, Eco-Friendly Development and Growth, allows all developmental sectors to engage in collaborative efforts based on mutual growth. This comprises economic, social, environmental and quality of life dimensions aiming towards achieving sustainable development in all aspects. Additionally, it provides a long-term framework for policy formulation and planning at all levels.

The Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (1992), Sections 35-36, stipulates the preparation and declaration of Environmental Quality Management Plans to comply with the national policy and plan for promoting and conserving the environmental quality under Section 13 (1). Since 1999, five editions of the Environmental Quality Management Plans have been declared and implemented. The Environmental Quality Management Plan 2023 - 2027 is a continuation of the previous edition. It serves as guidance for operational units to fulfill their duties, aligning the implementation of the Environmental Quality Management Plan with National Strategy, which is a 1st level plan. It is as well in compliance with Master Plan under National Strategy, the 13th National Economic and Social Development Plan (2023-2027), and the National Security Policy and Plan, which is a 2nd level plan. Apart from adhering to the philosophy of the sufficiency economy in establishing the framework, it also incorporates 12 fundamental principles which are Sustainable Development, Ecosystem Approach, Precautionary Principle, Polluters Pay Principle, Beneficiaries Pay Principle, Public-Private Partnership, Good Governance, Extended Producer Responsibility, Resource Decoupling/Resource Efficiency, Human Rights, Integration Principle, and Environmental Justice.

The development process of the Environmental Quality Management Plan 2023-2027 underscores the significance of inclusive participation from relevant developmental sectors. This can be done through seminars and open forums to gather input from experts and representatives from various sectors. It also highlights local communities' roles and rights in managing natural resources and the environment. Furthermore, the implementing, monitoring and evaluating guidelines have been established within the Management Plan 2023-2027 to ensure the plan management follows the quality management cycle which consists of 4 steps as follows: Plan, Do, Check, and Act. These steps shall lead to the efficient and tangible achievements of the Management Plan. In addition, the Environmental Quality Management Plan 2023-2027 has been conducted under the supervision of the Environmental Quality Management Plan Subcommittee and the National Environment Board (NEB). The Environmental Quality Management Plan 2023-2027 was approved at the 5th NEB meeting of 2022 on 28 October 2022. It was later presented to the cabinet for acknowledgment before being announced in the Royal Thai Government Gazette.

Office of Natural Resources and Environmental Policy and Planning sincerely hopes the Environmental Quality Management Plan 2023-2027 will serve as a valuable operational guideline for natural resources and environmental management. It aims to ensure that relevant agencies carry out their duties effectively, thereby enhancing the country's natural resources and environmental management to achieve national strategic goals, particularly in creating sustainable growth based on an environmentally friendly quality of life.

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Introduction



Introduction

The fast-paced development of countries, combined with the ever-changing global situations, inevitably leads to economic, social and environmental changes at the national, regional and international levels. For example, the global spread of the coronavirus 2019 pandemic (COVID-19), the rapid advancement in technology and innovation, the emergence of the digital economy era, the commitment to reduce greenhouse gas emissions, trade and investment obstacles, the global economic crisis and rapid urbanization. In terms of the environment, in particular, every country is grappling with natural resource depletion, degradation and threats such as wastewater, solid waste, air pollution as well as increasingly severe climate change. Therefore, in recent decades, the conservation, rehabilitation and preservation of natural resources and the environment have become critical and pressing issues. This is because natural resources are fundamental factors in production and are one aspect of a nation's development alongside the economic and social dimensions. Many countries are working together to prepare for potential challenges in order to establish balance and sustainability. International collaborations involve setting sustainable development goals that are mutually agreed upon by the participating countries. These goals include reducing greenhouse gas emissions, aiming for carbon neutrality, achieving net zero greenhouse gas emissions, promoting the concept of the Green Economy and implementing various agreements and measures such as the European Green Deal and the Carbon Border Adjustment Mechanism (CBAM). In Thailand, relevant agencies have been aware and collaborated to develop proactive measures for preventing and managing natural resources and the environment in a sustainable manner. This includes implementing controls, mechanisms, measures and standards to ensure the stability of the country's natural resources and environment.

Thailand has established a plan consisting of three levels. The National Strategy serves as the 1st level plan, providing a framework for developing consistent and integrated plans which shall be a solid foundation for achieving the nation's sustainable development goals under the good governance principle. The 2nd level plan, which includes Master Plan under National Strategy, the National Reform Plan, the National Economic and Social Development Plan and the Nation Security Policy and Plan, involves converting the national strategic goals and matters into practice. Lastly, the 3rd level plan comprises operational plans in various areas and the annual and 5-year state operational plans, ensuring all operations are aligned and moving in the same direction. The Environmental Quality Management Plan is considered a 3rd level plan which serves as the primary plan for managing natural resources and the environment. It is a comprehensive plan that integrates issues related to natural resources and the environment across all sectors, providing clear directions and goals for relevant agencies.

It serves as a common goal in the management of natural resources and the environment of Thailand.

Over the past period, Office of Natural Resources and Environmental Policy and Planning published a 20-year plan called the National Environmental Promotion and Conservation Policy and Plan 1997-2016, which was the first edition. At present, the Enhancement and Conservation of National Environmental Quality Policy and Planning 2017-2037, the second edition, has been announced. It was formulated in accordance with the Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (1992), Section 13 (1), which designates the said Office under Ministry of Natural Resources and Environment as the primary agency responsible for formulating such policies and plans for submission to the National Environment Board and subsequently for consideration by the Cabinet. The Environmental Promotion and Conservation Policy and Plan will be transformed into a 5-year medium-term operational plan, namely the Environmental Quality Management Plan, as stipulated in Section 35 of the Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (1992). The Office has already produced a total of 5 editions to date.

Office of Natural Resources and Environmental Policy and Planning has designated the Environmental Quality Management Plan 2023 – 2027 to be consistent and aligned with the 1st level and 2nd level plans while relating to various 3rd level plans to drive the management of natural resources and the environment of the country towards implementation at the function and area levels. The primary objective of the Plan is to enhance operational efficiency over a 5-year period and fulfill the vision of "A Secure Nation, Contented People, Continued Economic Growth, An Equal Society, and Sustainable Natural Resources". Such vision shall be pursued by implementing National Strategy and Master Plan under National Strategy, especially Strategic Direction 5: Eco-Friendly Development and Growth, as well as Master Plan under National Strategy on Issue 18: Eco-friendly Growth, regarding sustainable growth covering the dimension of managing Thailand's natural resources and environment. Other Master Plan's related issues include Issue (6) on Smart city and space, Issue (19) on Integrated Water Management and Issue (20) on Public Administration for the People. As well, the 13th National Economic and Social Development Plan (2023 – 2027) serves as the main guideline for formulating the Management Plan 2023-2027. It also emphasizes development strategies at both national and international levels, including sustainable development goals recognized by the United Nations member countries as well as the Bio-Circular-Green Economy (BCG) Model, which is a policy driving Thailand's sustainable development. Additionally, it aims to address current environmental and natural resource issues and enhance the country's potential by coordinating efforts and engaging all relevant developmental sectors.

Strategies
under the Environmental Quality Management Plan
2023-2027

Strategies

under the Environmental Quality Management Plan 2023-2027

1. Concepts: The Environmental Quality Management Plan 2023 – 2027 incorporates the Sufficiency Economy Philosophy (SEP) in conserving and sustainably utilizing natural resources and the environment in a balanced and appropriate manner to resource bases. Additionally, it integrates the concept of the Bio-Circular-Green Economy (BCG) Model, which involves the application of knowledge, technology and innovation to reduce resource consumption, create and add value, utilize waste materials and focus on environmental preservation. The contexts of related internal and external factors, which influence the country’s resolution of natural resource and environmental issues, have also been adopted by integrating natural resource and environmental management with economic and social development efforts. These efforts are aimed at promoting the development of the country while adhering to the international frameworks established by the United Nations. The objective is to achieve sustainable development goals and take into account situations of interstate conflicts, complex changes following new innovations and technologies, weather conditions and emerging diseases that affect the lives of people in the society and the economy.

2. Principles: There are 12 key principles in managing natural resources and the environment as follows:

2.1 Sustainable Development (SD) is a principle that emphasizes balanced development of the country in terms of the economy, society, and environment while promoting inclusivity and avoiding conflicts. In order to expand the economy with quality, it is essential to consider the limitations of natural resources and the need to conserve and sustainably utilize the environment for long-term benefits. This requires the efficient and sustainable use of all resources to meet current and future societal needs without adverse impacts.

2.2 Ecosystem Approach is a principle that considers the interconnected relationships (holistic approach) to ensure the balanced existence of the ecosystem and respond to human needs. It aims to promote sustainable use of natural resources and the environment by integrating the management of land, water and living organisms in the area to achieve a state of equilibrium. This approach includes protecting biodiversity, promoting sustainable resource utilization and ensuring equitable benefit-sharing.

2.3 Precautionary Principle is a proactive management approach that prioritizes the prevention of potential impacts by establishing protective systems for natural resources and the environment, especially in vulnerable and at-risk areas. Its goal is to avoid any potential

damage that may occur and to consider activities that pose risks and threats to human health or the environment.

2.4 Polluters Pay Principle (PPP) is an economic instrument used in the management of natural resources and the environment. Essentially, this principle states that individuals or entities who pollute or harm the environment are responsible for the expenses associated with preventing damage to human health or the environment.

2.5 Beneficiaries Pay Principle (BPP) is a principle that promotes accountability by incentivizing beneficiaries to compensate service providers for ecosystem services. This compensation is paid both at the source and destination of the services. The principle also fosters fairness for all affected parties, aiming to reduce social conflicts arising from the utilization of natural resources and ensure that all related parties benefit collectively from the outcomes.

2.6 Public–Private Partnership (PPP) is a principle that promotes shared responsibility and should be used in conjunction with the Polluters Pay Principle to encourage greater private sector investment and involvement in environmental management. It is also a principle for the successful implementation of public service projects. It involves collaboration between the government and other non-government entities to manage natural resources and the environment

2.7 Good Governance is a fundamental principle of good management that every organization should adopt as a guideline for governance. It encompasses ethical, moral and just behavior in all its aspects, fostering a culture where individuals adhere to and practice righteousness. This results in organizations being innovative, capable and efficient, gaining the trust and confidence of external stakeholders. Good Governance is based on 6 principles: the principle of legality, the principle of morality, the principle of transparency, the principle of participation, the principle of accountability, and the principle of value

2.8 Extended Producer Responsibility (EPR) is a principle that expands the scope of a producer's responsibility to cover each stage of a product's life cycle. The aim of EPR is to compel producers to improve their manufacturing processes and thereby promote environmental quality. This includes aspects such as take-back programs, recycling and disposal of product waste. The focus is on encouraging producers to enhance and develop product design and manufacturing systems to be more environmentally friendly, prolong the product lifespan.

2.9 Resource Decoupling / Resource Efficiency is a principle aimed at reducing the rate of resources used per unit of economic activity. It involves decreasing the quantity of materials, energy, water and other resources required for economic activities to operate at normal levels. This leads to a more efficient utilization of resources and helps to minimize the overall amount of pollution generated from economic activities.

2.10 Human Rights is a principle that considers the fundamental rights and freedoms of human beings to be equal, just, and non-discriminatory, regardless of their economic or social status. These rights also extend to the management of natural resources and the environment.

This includes the right to participate in the conservation and protection of natural resources, as well as to promote and preserve environmental quality. It also covers the right to live in a clean and healthy environment and the right to benefit from natural resources and biodiversity.

2.11 Integration Principle is a principle that aims to conserve natural resources sustainably and the environment by considering environmental issues in conjunction with economic and social development to prevent potential negative impacts.

2.12 Environmental Justice comprises both substantive and procedural environmental justices. Enforcement processes must accompany environmental laws to ensure equity and fairness.

3. Vision: “Ensuring abundant resources and environmental safety through comprehensive multidimensional management.”

4. Missions:

4.1 Cultivate awareness regarding efficient, balanced and sustainable utilization of natural resources.

4.2 Promote participation at all levels in the management of natural resources and the environment, fostering development and growth in harmony with the environment.

4.3 Develop guidelines, tools, systems, mechanisms and supportive data to ensure effective management and administration.

5. Objectives:

5.1 To provide development stakeholders with frameworks for the management of natural resources and the environment, ensuring efficiency, driving towards common goals and promoting sustainable development.

5.2 To ensure that the production and consumption of natural resources and the environment are balanced with resource bases and consistent with national development guidelines and changing resource and environmental conditions.

5.3 To support the achievement of national strategic goals for promoting growth based on an environmentally friendly quality of life.

6. Targets: The targets are to manage the country’s natural resources and the environment with clear operational directions, facilitating the achievement of objectives based on environmentally sustainable development.

7. Strategies: The Environmental Quality Management Plan outlines strategies that provide a practical framework for operation activities with clear guidelines. These strategies aim to drive environmental quality management towards achieving objectives based on environmentally friendly growth. They also foster integrated collaboration among relevant agencies, enabling them to be responsive to rapidly changing natural resource and environmental situations in various dimensions. The strategies prioritize different issues as follows:

- The alignment between the Environmental Quality Management Plan 2017-2022 and Master Plan under National Strategy regarding sustainable growth.
- The alignment between the strategies under the Environmental Quality Management Plan 2017-2022 and the strategies or missions of the primary partnership.
- Guidelines for implementing natural resource and environmental management plans at the local level.
- Consistency with environmental factors affecting the management of natural resources and the environment in the future.

The core ideas in crafting the Environmental Quality Management Plan 2023-2027 are as follows:

7.1 Refine the framework of the Environmental Quality Management Plan. This to harmonize with Master Plan for effective dissemination. Aligning strategies under the Environmental Quality Management Plan directly with focal points or subsidiary plans under Master Plan. This not only increases the chances of goal attainment but also streamlines operational efforts among agencies and optimizes resource allocation for more responsive goal achievement.

7.2 Adjust operational mechanisms and agency roles. It is imperative for development stakeholders involved in natural resource and environmental management to acknowledge and actively support the Environmental Quality Management Plan. This fosters coherence in the operational directions of each agency. Consideration may be given to expanding the roles and responsibilities of agencies to cover strategic issues relevant to those agencies, as well as integrating cooperation among agencies to align operational endeavors with the strategies and operational guidelines of the Environmental Quality Management Plan.

7.3 Adjust the course of management according to the Environmental Quality Management Plan. The key points under the Environmental Quality Management Plan should be aligned and correlated with the current evolving trends in natural resource and environmental management. This is crucial in shaping strategic decision-making and policies to accommodate future changes, thus ensuring the plan remains efficient and up-to-date. For instance, efforts could be focused on integrating environmental education within the academic sphere to instill awareness, build knowledge, correct understanding and raise awareness of the importance of the environment. Furthermore, it is crucial to review legislation relevant to the Environmental Quality Management Plan to enhance clarity. Promoting activities that highlight the environmental significance while considering social and economic contexts and prioritizing the development and utilization of technology in managing natural resources and the environment are also essential.

7.4 Integrate the planning of natural resource and environmental management. This process involves a combination of top-down and bottom-up approaches by improving the participation of operational units and local representatives who possess knowledge and

understanding of their respective contexts. This collaboration helps to refine related laws and regulations to be up to standard for more efficient implementation, which reduces obstacles when implementing the plans of lower levels. Additionally, the plan should be continuously revised and developed throughout its duration to allow operational flexibility and alignment with strategic objectives and legal compliance. The aim is to ensure the plan is effectively implemented, leading to the established goals. Since the top-down management approach often involves broad-scale planning, it may fail to consider the complex and diverse social and economic contexts of an area, leading to operational challenges during plan implementation. Additionally, changes in the area's context may lead to operational activities that are not in line with the intended objectives. Plans often undergo revisions based on organizational experiences, recommendations, or analyses conducted by academics or relevant agencies. Moreover, proactive error-prevention planning ensures that the plan addresses critical issues necessary for the management of natural resources and the environment.

The Environmental Quality Management Plan 2023-2027 consists of 5 strategies, 13 sub-strategies and 33 indicators. The diagram illustrates the connection between the (draft) Environmental Quality Management Plan 2023-2027 and the 1st and 2nd level plans, as depicted in Figure 1.


Level 1 Plan	National Strategy 2018-2037 Strategic Direction 5: Eco-Friendly Development and Growth				
Level 2 Plan	Master Plan under Strategy Issue (18) Eco-friendly Growth	National Reform Plan (revised 2021)	13 th National Economic and Social Development Plan	National Security Policy and Plan on National Security (2019-2022)	
Level 3 Plan	Enhancement and Conservation of National Environmental Quality Policy and Planning 2017-2037				
Environmental Quality Management Plan 2023-2027					
Vision: Ensuring Abundant Resources and Environmental Safety through Comprehensive Multidimensional Management					
Strategies	1. Management of Terrestrial Natural Resources and Biodiversity for Growth and Fairness Based on the Balance of Natural Resources Base	2. Conservation and Restoration of Marine Ecosystems for the Sustainable Development of Marine Source Utilization Potential	3. Management to Promote a Climate-friendly Society	4. Managing Pollution that Impacts the Entire Ecosystem and Urban Environment	5. Paradigm Shift for Efficient Natural Resources and Environmental Management
Indicators	<p>1.1 The national land area is composed of 45% green areas designated as forests, with 33% being natural forest areas and 12% being economic forest areas (in percentage)</p> <p>1.2 The Thailand Red List Index is an index that tracks the status changes of plant and animal species that are vulnerable to threats in Thailand. (0-1)</p> <p>1.3 The total area of land use changes in unsuitable areas under the Agricultural Area Management Project (Zoning by Agi-Map) (rai).</p> <p>1.4 Mineral mining and basic industry enterprises have been certified with the Corporate Social Responsibility for Mineral Industry Operators (CSR-DPIM) and Green Mining (number)</p> <p>1.5 Financial mechanism and projects under the financial mechanism supporting the conservation, restoration and utilization of natural resources and biodiversity (number)</p>	<p>2.1 The protected and conserved marine and coastal areas increase (in percentage)</p> <p>2.2 The designated balanced areas expand (area)</p> <p>2.3 2.3 The healthy coral areas remain stable, not less than 30% (in percentage)</p> <p>2.4 Mangrove forest areas expand (rai)</p> <p>2.5 A minimum of 250 tons of marine debris is managed annually (tons per year).</p>	<p>3.1 A minimum reduction of 21% in overall greenhouse gas emissions compared to business-as-usual (in percentage)</p> <p>3.2 The ratio of renewable energy usage to total final energy consumption increases (in percentage).</p> <p>3.3 The death rate and the number of people affected by natural disasters per 100,000 population decrease (people per 100,000).</p> <p>3.4 The percentage of local development plans that integrate disaster management increases (in percentage).</p>	<p>4.1 85% of surface water quality is in good condition and 89% of marine water sources meet good quality standards (in percentage)</p> <p>4.2 Areas experiencing improved air quality account for 80% (in percentage)</p> <p>4.3 Roadside noise levels are within standard limits (in percentage)</p> <p>4.4 80% of municipal solid waste is properly controlled (in percentage)</p> <p>4.5 50% of hazardous municipal waste is properly controlled (in percentage)</p> <p>4.6 100% of infectious solid waste is correctly controlled, adhering to academic principle (in percentage)</p> <p>4.7 An additional ecological spatial plan has been developed for 1 more region (number of regions)</p> <p>4.8 A minimum of 22 model cities have been developed based on landscape ecology (number of cities)</p> <p>4.9 The country has a minimum of 10 square meters of green public space per person (square meter per person)</p> <p>4.10 An efficient management system of natural and cultural environments is in place</p>	<p>5.1 The domestic material consumption per gross domestic product decreases (kilograms per US dollar)</p> <p>5.2 Development of eco industrial town across 39 provinces and 54 areas (number of provinces/areas).</p> <p>5.3 The proportion of sustainable agricultural land to total agricultural area increases (in percentage)</p> <p>5.4 Thailand's rank in the development of travel and tourism in environmental sustainability is within the top 67 (rank)</p> <p>5.5 The proportion of agencies participating and the proportion of green procurement increase (percentage)</p> <p>5.6 Environmental awareness and cooperation increase (number)</p> <p>5.7 The Strategic Environmental Assessment (SEA) process is applied in key developmental policy areas (yes/no).</p> <p>5.8 The number of actions under bilateral, multilateral and regional agreements related to the natural resource and environmental management increases (number).</p>
Sub-strategies	<ul style="list-style-type: none"> Conservation, restoration and sustainable utilization of natural resources Preparation for sustainable bio-based economic development 	<ul style="list-style-type: none"> Conservation, restoration, and utilization of marine and coastal resources and ecosystems Preparedness to support sustainable marine and coastal resource-based economies 	<ul style="list-style-type: none"> Reduction of greenhouse gas emissions across all sectors Enhancing preparedness for adaptation and reduce mitigating the impacts of climate change and disasters throughout the system 	<ul style="list-style-type: none"> Enhancing the efficiency of preventing, reducing and eliminating pollution Managing community environments and natural and cultural environments Strengthening the mechanisms for pollution control 	<ul style="list-style-type: none"> Promoting sustainable production and consumption Promoting desirable environmental characteristics and behaviors Promoting the development of tools and infrastructure for natural resource and environmental management Promoting the development of projects and networks to elevate the paradigm of natural resource and environmental management

Figure 1: The connection between the Environmental Quality Management Plan 2023 – 2027 and the 1st - 3rd plans and the Sustainable Development Goals

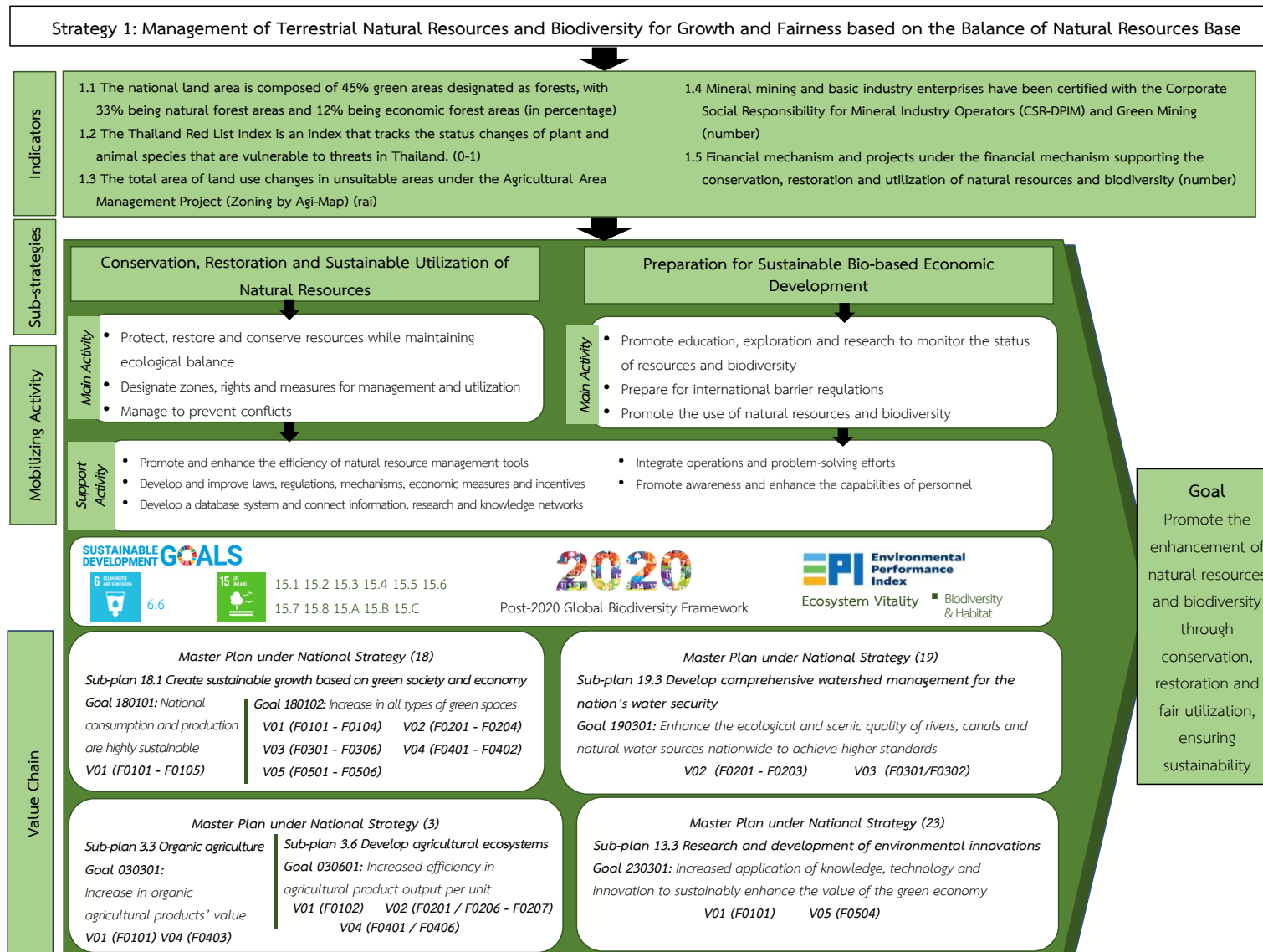


Figure 2: Strategy 1 Management of terrestrial natural resources and biodiversity for growth and fairness based on the balance of natural resource base

Strategy 1: Management of terrestrial natural resources and biodiversity for growth and fairness based on the balance of natural resources base

Goal: Promote the enhancement of natural resources and biodiversity through conservation, restoration and fair utilization, ensuring sustainability.

- Indicators:**
- 1.1 The national land area is composed of 45% green areas designated as forests, with 33% being natural forest areas and 12% being economic forest areas (in percentage).
 - 1.2 The Thailand Red List Index is an index that tracks the status changes of plant and animal species that are vulnerable to threats in Thailand. (0-1)
 - 1.3 The total area of land use changes in unsuitable areas under the Agricultural Area Management Project (Zoning by Agi-Map) (rai).
 - 1.4 Mineral mining and basic industry enterprises have been certified with the Corporate Social Responsibility for Mineral Industry Operators (CSR-DPIM) and Green Mining (number).
 - 1.5 Financial mechanism and projects under the financial mechanism supporting the conservation, restoration and utilization of natural resources and biodiversity (number).

Natural resources, such as land, water, forests, animals, air and minerals, are fundamental factors for sustaining life. Humans derive various benefits from these resources, including food sources, medicines, habitats and energy-driven transportation. However, it is vital to utilize these resources in a way that considers both quantity and quality to maintain a balance that does not jeopardize the livelihoods and sustainability of natural resources.

Many countries have implemented initiatives to expand green spaces through reforestation and forest rehabilitation. This has resulted in a slower worldwide decline in forest areas. However, when considering ecosystem services, it is evident that restored or planted forest ecosystems still cannot match the natural forest ecosystem services. Moreover, more than half of the habitable land on Earth is used for food production, potentially requiring an additional 50% of current agricultural land to accommodate the increasing global population. In addition to the challenges surrounding agricultural land use, there are concerns regarding soil degradation and desertification. At present, soil degradation affects over 20% of all lands, posing significant impacts on 3.2 billion people residing in these areas. This aligns with the Living Planet Report 2020, which indicates a global decline in wildlife populations due to human activities. Various species populations are decreasing and the extinction rate is rising, with the Living Planet Index (LPI) dropping by over 60%. Concerning the state of freshwater ecosystem and freshwater resources, which serve as crucial habitats for numerous species, reports indicate that since 1970, over 40% of the world's wetlands have been destroyed due to agricultural development, urban growth, infrastructure development and excessive use of freshwater resources. This degradation has had a negative impact on freshwater fisheries,

resulting in the loss of income for millions of people worldwide. Economic assessments of the loss of wetland areas from 1996 to 2011 estimated a value of 2.7 trillion US dollars per year.

Therefore, to ensure the efficient management of terrestrial natural resources and biodiversity, policies, plans and agreements have been established. One such initiative is the Sustainable Development Goal 15, which seeks to protect, restore and promote the sustainable utilization of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss. There are sub-objectives covering a range of issues, such as the conservation and restoration of terrestrial ecosystems, mountains, freshwater and biodiversity, as well as the sustainable utilization of ecosystem services. Strengthening resilience to prevent desertification, fair sharing of biodiversity benefits, reducing degradation of natural animal habitats, integrating the value of ecosystems and biodiversity into national policy and strategy formulation and enhancing local and global collaboration to conserve and halt illegal wildlife and plant trades, among other measures. Furthermore, international agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) or the Washington Convention aim to conserve global wildlife and forest resources, focusing on endangered or threatened species through the establishment of a global network to regulate international trade. Similarly, the Convention on Biological Diversity (CBD), through the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefit Arising from Their Utilization, strengthens opportunities for fair and equitable benefit-sharing. Additionally, the Cartagena Protocol on Biosafety, which is a supplementary protocol to the Convention on Biological Diversity, covering the regulation of the cross-border movement, transfers, transit, transportation and utilization of genetically modified organisms, which may have negative effects on the conservation and sustainable use of biological diversity. The Ramsar Convention on Wetlands aims primarily to conserve and prevent the loss of wetlands globally while also advocating for their responsible and sustainable utilization. The Convention on Migratory Species (CMS) focuses on conserving terrestrial, marine and avian migratory species effectively. The 1st draft of the Post -2020 Global Biodiversity Framework, following the strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets, concluded in 2020, aims to conserve, restore as well as wisely and sustainably utilize biodiversity by 2050.

ASEAN region is recognized for its rich biodiversity. However, the biodiversity situation is currently experiencing various pressures, including deforestation and changes in land utilization, resulting in habitat deterioration and the intrusion of invasive alien species. ASEAN region has lost over 13% of its forest areas since 1992, and it is projected that up to 75% of the original forest areas in the region could disappear by 2100. This loss of forest areas is a significant contributor to the decline in critical habitats and species diversity. In response, the ASEAN Senior Officials on Forestry (ASOF) have been appointed and the Strategic Plan of Action for ASEAN Co-operation in Forestry (2016-2025) has been developed. The goal is to promote sustainable forest management for the continuous and balanced production of

forest goods and services. Additionally, the plan seeks to ensure forest preservation, biodiversity conservation and improve the efficiency of utilization for sustainable socio-environmental benefits. The ASEAN Strategic Plan on Environment 2016-2025 (ASPEN) has been set up to serve as a framework that supports ASEAN's environmental efforts across a diverse range of issues, including nature conservation, biodiversity and water resource management. The formation of the ASEAN Working Group on Nature Conservation and Biodiversity (AWGNCB) aims to promote collective awareness of sustainable development and foster environmentally friendly practices. Furthermore, the Association of Southeast Asian Nations (ASEAN) has collaborated to establish the ASEAN Centre for Biodiversity (ACB). The goal is to encourage member countries to focus on various issues related to biodiversity, including agriculture and food security, fair access to and sharing of benefits from biological resources, climate change, eco-tourism, wildlife protection, management of invasive alien species, peat swamp forest conservation and the management of biodiversity data and knowledge.

Thailand's forest area has remained relatively stable over the past 7 years. In 2021, the forest area was approximately 102.21 million rai, equivalent to 31.59% of the total land area of the country. However, this figure remains below the target set in the 13th National Economic and Social Development Plan, which aims for 45% of the country's total area to be covered by forests. The populations of many wildlife species have been declining and are currently facing a worrying situation, especially those vulnerable to threats such as habitat loss due to deforestation, illegal logging and the illegal trade of wildlife. These factors have resulted in the extinction of certain wildlife species. Additionally, there are 991 plant species that are in danger of extinction. Moreover, Thailand faces natural soil problems, with the largest area being shallow soil in 2017, followed by sandy soil. The majority of the land is used for agriculture. In terms of mineral resources, they are found in all regions of the country and can be categorized into 9 groups which are fossil fuels and energy mineral, industrial rocks and decorative mineral stones, mineral for cement industry, precious metals, basic metals, iron, ferrous alloys, ceramics industrial minerals, other industrial minerals, light metals and rare minerals. Therefore, mining operations cannot select their locations and must conduct a thorough examination of the potential impacts of mining as well as create plans for post-mining restoration. Regarding water resources, between 2011 and 2020, Thailand experienced a decrease in average rainfall. In 2020, the runoff volume in Thailand's 22 river basins increased by 31.36% compared to 2019. The volume of water in large and medium-sized reservoirs increased in 2021 by 0.35% and 31.51% respectively, compared to the previous year. Groundwater data from 1,175 observation well stations, comprising a total of 2,120 wells across 27 groundwater basins, revealed a stored groundwater volume of 1,137,587 million cubic meters per year in 2020. Of that, 45,386 million cubic meters can be safely utilized annually. Based on the annual report of National Strategy implementation for 2021, the water management system still faces challenges in achieving the set goals. Thailand places great importance on terrestrial natural resource management and biodiversity.

Consequently, it incorporates various issues into national plans across 3 different levels. Examples of these plans include Strategic Direction 5 under National Strategy 2018-2037 regarding Eco-Friendly Development and Growth and Issue 1 on promoting green growth and sustainable development . Other plans are Issue (18) of Master Plan under National Strategy 2018-2037, Eco-friendly Growth with a sub-plan regarding sustainable growth within a green socio-economic framework and Issue (19) of Master Plan under National Strategy 2018-2037 on Integrated Water Management. This issue has sub-plans encompassing comprehensive watershed management systems to enhance the nation's water security as well as the conservation and rejuvenation of rivers, canals and natural water sources nationwide. Additionally, there are several points under the 13th National Economic and Social Development Plan 2023-2027, notably Milestone 1, which indicates Thailand as a leading country in agricultural products and high-value processed agricultural products, Milestone 10 indicating Thailand's circular economy and low carbon society and Milestone 11 indicating Thailand's ability to mitigate risks and impacts from natural disasters and climate change. Lastly, the 1st Policy under the National Enhancement and Conservation of National Environmental Quality Policy and Planning 2017-2037 indicates secure management of natural resource base for balanced, equitable and sustainable development.

1. Development Agenda

Forest and water resources: Forest resources are natural resources of the utmost importance to all living things. They play vital roles in conserving water and soil, maintaining the Earth's atmospheric layers and nurturing the biodiversity of plants and animals. They also serve as sources for producing various goods and services that contribute to the economic well-being of humanity. Thailand has recognized the importance of the management of forest and water resources. Therefore, the National Forest Policy Committee, along with other relevant agencies, has formulated National Forest Policy to promote conservation, restoration and sustainable utilization of these resources. Some of these included policies are the Community Forest Act 2019 and the National Forest Development Master Plan. These policies have been integrated with several other policies and plans, such as the fourth aspect under the 20-Year Water Resource Management Master Plan 2018-2037. This aspect focuses on water quality management and water resource conservation by revitalizing rivers, canals and natural water sources. The fifth aspect stresses the importance of conserving and restoring degraded watershed forests as well as preventing soil erosion. The objective is to safeguard and revitalize degraded watershed forest areas and prevent and mitigate soil erosion in the watershed and sloped areas. In addition, the sixth aspect regarding management promotes cooperation with all sectors. This involves establishing water resource management organizations, updating legislation, conducting research studies and promoting public awareness and participation of communities and relevant sectors. Moreover, it entails creating awareness for resource conservation to improve local and river basin water management,

establishing the 20-Year Groundwater Resource Management Strategy 2017-2025 as well as the ASEAN Environment Action Plan 2018 of Thailand (revised edition, 2019)'s Strategy 1 for environmental and biodiversity conservation and Strategy 3 for water resource management.

Soil resources and land use: Soil resources offer extensive benefits to both humans and other living organisms. Soil comprises of organic matter, nutrients and water that are essential for plant growth. It serves as a source of food and habitat for certain animal species. Additionally, it is the foundation of human settlements, creating diverse cultures and civilizations. Furthermore, soil acts as a water reservoir, encompassing both surface and groundwater. In Thailand, as of 2018, problem soil covered an area of 60,025,262 rai, equivalent to 18.71% of the country's total area. The main problem soil that covered the largest area was shallow soil, accounting for 11.90%, followed by sandy soil at 3.71% of the total area.

The Report on the State of the Environment 2021, showing land use data from 2017-2018, indicates that the majority of land was utilized for agricultural purposes, with the largest area covering 178.74 million rai. Following that was forest land, with an area of 104.66 million rai. Community and building areas made up 18.74 million rai, while water sources spanned 9.37 million rai and miscellaneous areas covered 9.19 million rai.

In addition, soil contamination caused by the use of chemical fertilizers and agricultural chemicals has become a growing concern. This is due to the increasing importation of hazardous agricultural chemicals over the past decade. Consequently, relevant authorities have implemented policies and plans to prevent soil deterioration and restore its quality, while also ensuring appropriate land use. For instance, the 20-Year Water Resource Management Master Plan (2018-2037), Section 5, focuses on preserving and rejuvenating deteriorating watershed forest areas. This is done by preventing soil erosion and preventing and reducing soil erosion in the watershed and sloped areas. There is also the 20-year Problem Soil Resource Management Plan (2018-2037) in place. Other initiatives include altering land use through the declaration of Royal Decrees designating areas for land reclamation in different regions and the implementation of the Agricultural Area Management Project (Zoning by Agri-Map) by the Ministry of Agriculture and Cooperatives to address improper land use.

Mineral resources: Mineral resources play a significant role in a country's stability and prosperity. They are used in various forms of production, such as raw industrial materials, electricity generation and weapon manufacturing. In Thailand, there are more than 40 types of mineral resources, covering an area of approximately 96,730 square kilometers (60 million rai), which accounts for 19% of the country's total area. Rock salt minerals are the most abundant mineral resource in the country with an estimated volume of around 18 million tons, making up 92.08% of the country's total mineral resources. In 2020, the total mineral production was approximately 243.27 million metric tons, valued at 70,708 million baht. Among these, industrial limestone for construction was the most produced and utilized mineral. Coal, primarily used for fuel, had the highest volume of imports while gypsum was the mineral with the highest volume of exports. Efforts have been directed towards promoting

the sustainable conservation and utilization of mineral resources through effective management strategies incorporated into various plans and policies. For instance, the 20-Year Mineral Management Strategy (2018-2037) aims to guide the country's mineral management towards secured, prosperous and sustainable development. This involves transitioning the industrial production sector towards green industries and adopting good governance and environmentally friendly mining practices (Green and Smart Living), ensuring sustainability within the economic, social, environmental and public health balanced growth. This period signifies a phase where the nation enjoys stability in both domestic and international mineral resources, mainly supporting the development of the domestic industrial economy. The appropriate and equitable development of mineral resources benefits the population, enhancing the country's economic prosperity. Overall, the country's mineral management is comprehensive and guided by the principles of Sufficiency Economy Philosophy and sustainable development.

Biodiversity: Biodiversity refers to all forms of life, including plants, animals, microorganisms and humans, coexisting within diverse ecosystems. These biological resources are fundamental in promoting development since they are utilized across a wide range of industries. The loss of biodiversity can significantly affect the functioning of ecosystems. Thailand places great importance on conserving, restoring and utilizing biodiversity. This led to the formulation of the ASEAN Environmental Action Plan of Thailand 2018-2025 (revised edition, 2019), Strategy 1, focusing on conserving the environment and biodiversity. It has also developed Thailand's Development Strategy based on the BCG Economic Model 2021-2027, Strategy 1, with a primary focus on establishing sustainability in resource base and biodiversity by balancing conservation and utilization. Additionally, the Biodiversity Act B.E... has been drafted to serve as central legislation to improve the management of Thailand's biodiversity at all levels and sectors. Furthermore, Thailand has proposed that two of its national parks be registered as ASEAN Heritage Parks, namely the Chao Mai National Park, with its wildlife sanctuary on Libong Island and the Ang Thong National Marine Park. Both parks have been endorsed as the 45th and 46th ASEAN Heritage Parks respectively at the 15th ASEAN Ministerial Meeting on Environment held on 8 October 2019, in Sihanoukville, Kingdom of Cambodia.

2. Details of Strategies: Based on the analysis of the development situation and other relevant policies and plans across all levels, Strategy 1 focuses on the significance of conserving, restoring and utilizing natural resources. It takes into account the ecological resilience limitations and capacities and aims to maintain the stability of natural resource base in an equitable and balanced way. Its objective is to ensure that the sharing of benefits derived from the use of natural resources is fair and equal, especially for the underprivileged and marginalized. This is important to reduce societal disparities and conflicts as well as to promote improvements and developments. In addition, the strategy seeks to drive improvements, developments and the establishment of legislation to regulate the management of natural

resources. This involves decentralizing power, building partnership and ensuring justice processes concerning natural resources and the environment, with an emphasis on the effective law enforcement. There is also a focus on developing standardized database systems that can be interconnected nationwide, utilizing geospatial information technology for efficient natural resource and environmental management. The overarching goal is to promote sustainable, equitable and stable conservation, restoration and utilization of natural resources and biodiversity. It comprises 2 sub-strategies as follows:

Sub-strategy 1.1 Conservation, restoration and sustainable utilization of natural resources: This is done by taking into account the limitations and capacities of the ecological resilience to maintain the stability of natural resource base in an equitable and balanced way. This highlights 6 key points: forest resources, wildlife resources, biodiversity, surface and groundwater resources, soil resources and mineral resources. There are important operational activities including the prevention, restoration and conservation of resources, safeguarding fossils, managing conflicts between wildlife and human utilization, managing watershed forest areas, flooding control, maintaining ecological balance, establishing scientifically and legally sound mechanisms and promoting new conservation practices. Furthermore, there are supporting and promoting initiatives such as the creation of mechanisms and regulations, economic measures and incentive schemes. They also involve the development of database systems, research activities, knowledge dissemination and technologies as well as raising awareness and encouraging participation in the conservation and sustainable utilization of resources. Integrating data and promoting interagency collaboration are also critical components of these efforts.

Sub-strategy 1.2 Preparation for sustainable bio-based economic development: This is done by adjusting projects and developing management systems for biological resources to support sustainable economic development based on biological resource base. This involves considering the ecological resilience limitations and capacities. This sub-strategy emphasizes 2 key points: (1) structural and regulatory improvements to accommodate economic development based on biological resource base and taking into account the limitations of natural resources that need to be preserved for long-term benefits and (2) management systems for biological resource base to ensure sustainable economic use. Important operational activities include accelerating efforts to conduct studies, surveys and research to monitor the status of significant resources and biodiversity, extending to industrial utilization. Others involve domestic preparation for international barrier regulations, promoting and creating awareness in the educational sector. In addition, supporting activities include refining regulations and measures considering natural resource limitations, developing

databases and networks, promoting knowledge and enhancing the capabilities of personnel in utilizing natural resources in line with the bioeconomy framework.

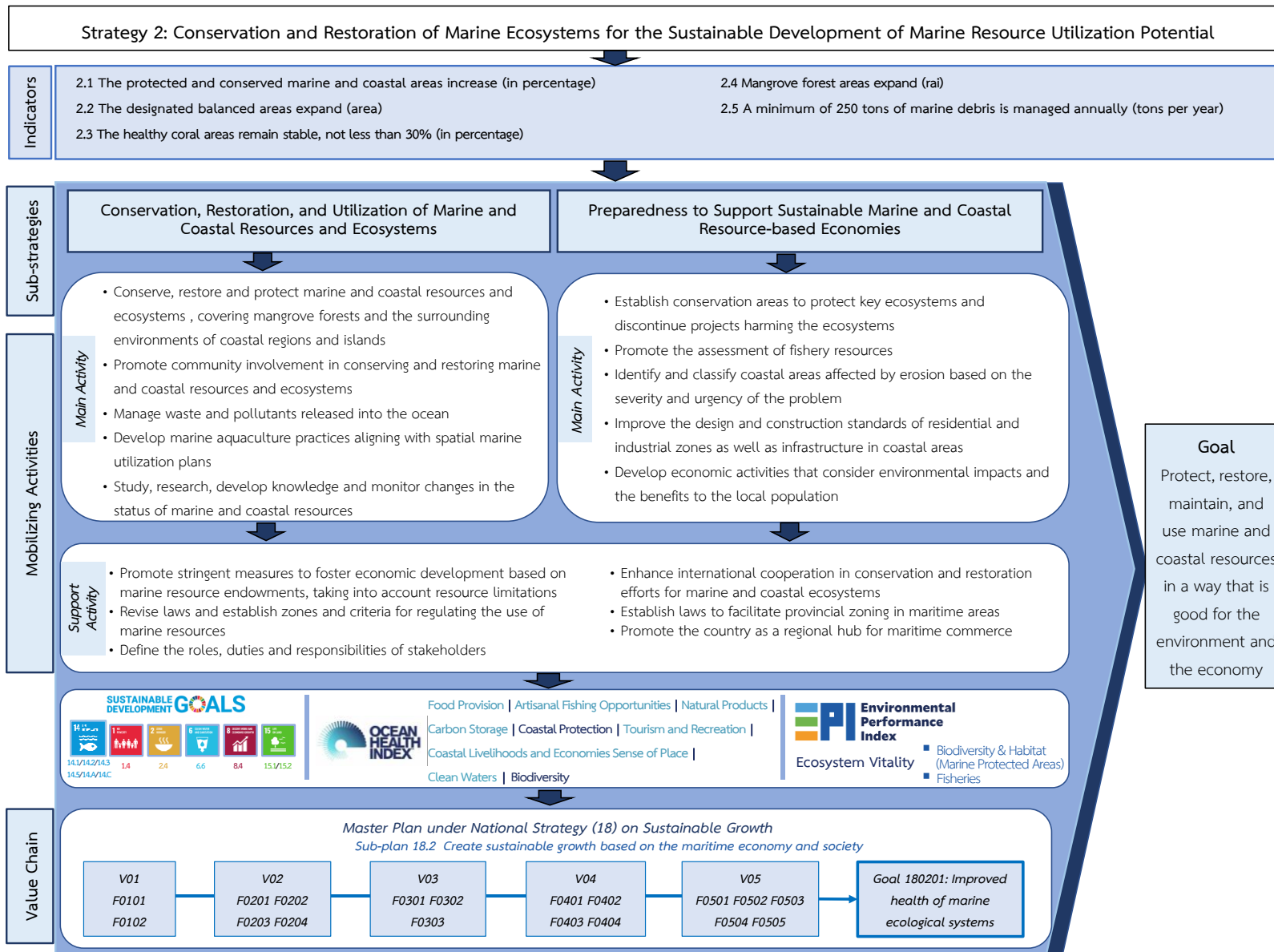


Figure 3: Strategy 2 Conservation and restoration of marine ecosystems for the sustainable development of marine resource utilization potential

Strategy 2: Conservation and restoration of marine ecosystems for the sustainable development of marine resource utilization potential

Goal: Protect, restore, maintain, and use marine and coastal resources in a way that is good for the environment and the economy.

- Indicators:**
- 2.1 The protected and conserved marine and coastal areas increase (in percentage).
 - 2.2 The designated balanced areas expand (area).
 - 2.3 The healthy coral areas remain stable, not less than 30% (in percentage).
 - 2.4 Mangrove forest areas expand (rai).
 - 2.5 A minimum of 250 tons of marine debris is managed annually (tons per year).

Marine and coastal resources are essential for driving Thailand's economy and play a crucial role in propelling regional and global economies. However, significant changes have occurred in the condition of oceans and coastlines. These changes are mainly caused by shifts in global climatic conditions, resulting in an increase in acidity, temperatures and sea levels. The exploitation of marine and coastal resources for food production, settlement, tourism and energy production has resulted in the degradation or loss of marine ecosystems. This is particularly evident in the death or deterioration of coral reefs. Such degradation has a major impact on the food chain of marine ecosystems and humans whose livelihoods rely on marine and coastal resources. Moreover, marine species are under increasing threat and face the risk of extinction. In addition, marine pollution, such as marine debris and microplastic contamination, along with oil spills, directly affects the quality of seawater and marine ecosystems. These changes profoundly affect marine ecosystems, including mangrove forests, beach forests, corals, seagrass beds, coral reefs, marine animals and plants. Additionally, coastal erosion directly affects the balance of ecosystems and biodiversity of marine and coastal ecosystems.

Countries around the world are working towards achieving efficient and sustainable management of marine and coastal resources on a global scale. They are addressing emerging issues through the development of plans, policies and agreements, all of which underscore the significance of managing marine and coastal resources. For instance, the Sustainable Development Goals (SDGs), specifically Goal 14, aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development. Its sub-goals focus on establishing frameworks for sustainable management and protection of marine and coastal ecosystems. For instance, Sub-Goal 14.1 aims to significantly prevent and reduce all forms of marine pollution, particularly pollution originating from land-based activities, as well as marine debris and nutrient pollution by 2025. Sub-Goal 14.2 focuses on the sustainable management and protection of marine and coastal ecosystems to mitigate severe impacts as well as strengthening resilience and restoration initiatives, thereby fostering productive, healthy and thriving oceans by 2020. Sub-Goal 14.3 focuses on reducing and addressing the impacts of ocean acidification, including through enhanced scientific cooperation at all levels. Sub-Goal 14.5 aims to preserve at least 10% of marine and coastal areas by 2020, in accordance with

both national and international laws and based on the best available scientific data. Sub-Goal 14.a aims to enhance scientific knowledge, develop research capabilities and disseminate marine technology, adhering to the guidelines and practices for marine technology transfer set forth by the Intergovernmental Committee on Oceanography. This initiative seeks to improve the ocean quality and promote marine diversity in order to support the development of developing countries, particularly those that are small island states and the least developed countries. Lastly, Sub-Goal 14.c aims to strengthen the conservation and sustainable use of oceans and their resources, in accordance with the United Nations Convention on the Law of the Sea (UNCLOS). This agreement provides a regulatory framework for oceanic and maritime affairs, promoting the conservation and sustainable use of oceanic resources, as detailed in paragraph 158 of The Future We Want document. It shall be pursued with respect to the sovereignty of each state as deemed appropriate. The operation approach will facilitate international communication and promote the peaceful and appropriate use of marine and oceanic resources. The agreement specifies that the utilization of marine and oceanic resources must be fair and effective, while also emphasizing the importance of conservation, education and protection of marine resources and marine environment in conjunction with their utilization. In addition, the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) is an international agreement established under the International Maritime Organization. Its objective is to prevent marine pollution caused by ships, whether it is due to routine operations or accidents, and it covers pollutants harmful to the marine environment. This convention sets forth regulations requiring signatory states to take action to reduce and prevent pollution from ships. It also provides for penalties to be imposed on vessels that violate these regulations. In ASEAN region, marine and coastal resources exhibit diverse and rich ecosystems. With coastal areas spanning over 173,000 kilometers, ASEAN houses mangrove forests and coral reefs covering 35% and 30% of the world's total mangrove forest and coral reef ecosystems, respectively. ASEAN member nations extensively utilize marine and coastal resources for economic gains, with marine products and goods from the region constituting 14% of the world's total marine products and goods. As a result, the utilization of marine and coastal resources in various activities has had significant negative impacts on marine and coastal resources and the environment. This results in substantial continuous degradation of coastal areas and the overall marine environment in ASEAN region. To ensure sustainable management and preservation of coastal and marine ecosystems, various issues are addressed through policies, plans and collaborative frameworks. For instance, the Bangkok Declaration on Combating Marine Debris in ASEAN Region was ratified by ASEAN members during the 34th ASEAN Summit in Bangkok on 22 June 2019. This declaration underscores the earnest and sustainable resolution of marine debris problems. Countries in the region are committed to supporting innovative ideas, boosting research capacity and applying scientific knowledge while promoting multi-sectoral involvement. The ASEAN Framework of Action on Marine Debris has been developed following recommendations from the ASEAN Conference on Reducing Marine

Debris in ASEAN Region 2017, which took place in Phuket, Thailand, from 21 – 24 November 2017. During this event, an assessment of marine pollution caused by marine debris in ASEAN region was undertaken, examining local, regional and global viewpoints. Furthermore, there was an integration of the United Nations' obligation on Sustainable Development Goal, specifically Goal 14, and the ASEAN. The ASEAN Socio-Cultural Community Blueprint 2025 is incorporated with national plans and policies with an aim to promote cooperation in protecting, restoring and sustainably utilizing marine and coastal environments. It also seeks to address and manage the risks of pollution and threats to marine and coastal ecosystems, particularly in ecologically vulnerable areas. Moreover, there is an exchange of information concerning national policies, best practices as well as the identification of gaps and challenges, focusing on 2 main approaches to addressing issues. These approaches include policy and management strategies as well as innovative technological solutions. The ASEAN Framework of Action on Marine Debris consists of 4 aspects which are: (1) Policy and planning support with a focus on the promotion of regional policy negotiations in preventing and reducing marine debris from both land-based and marine activities. This is achieved through the sharing of information and knowledge, as well as the enhancement of regional coordination. Additionally, it involves strengthening multisectoral policy measures to manage marine debris and prioritizing national and ASEAN development agendas. (2) Research, innovation and capacity development with a focus on collecting fundamental regional data regarding the status and impacts of marine debris in ASEAN region. This initiative also promotes the integration and application of scientific knowledge to support decision-making in science and policies concerning marine debris prevention and management. (3) Creating awareness, education and public relations with efforts directed towards accelerating strategies/campaigns to promote behavioral changes to combat marine debris. It also involves integrating marine debris issues into ASEAN's cultural initiatives and promoting platforms for knowledge sharing, including innovative approaches and best practices in marine debris mitigation. Lastly, (4) Encouraging private sector involvement with a focus on integrating the participation of private sector and industries in implementing measures to tackle marine debris problems. This includes promoting investment in combating marine debris in the oceans. The ASEAN Regional Action Plan for Combating Marine Debris 2021-2025 aims to serve as an operational guideline for ASEAN, fostering collaboration among member countries and seeking long-term solutions for the use and management of marine debris in the region. It underscores the current status and challenges that ASEAN members must confront as well as identifies strategies for managing the entire value chains to combat unsustainable plastic usage, plastic waste management and marine pollution for the next 5 years. The Action Plan includes strategies for managing marine debris which encompasses 3 critical steps in the value chains of plastic waste. These steps involve reducing production factors entering the systems, enhancing storage and reducing leakage as well as creating value for recycled waste. Similar to the ASEAN Framework of Action on Marine Debris, the Action Plan covers 4 keys areas. The management discussion

took place during the Special ASEAN Ministerial Meeting on Marine Debris (SAMM-MD) on 5 March 2019. The objective is to position ASEAN as a platform for exploring and executing practical approaches to combat marine debris issues, while enhancing cooperation among ASEAN members and supportive partners to efficiently address marine debris problems in the region. This entails expanding support to strengthen sustainable partnership and fostering cooperation within the ASEAN framework, particularly in preventing marine debris in the ASEAN region. Discussions also centered around future approaches for preventing and reducing marine debris, including proposing the Bangkok Declaration on Combating Marine Debris in ASEAN Region, which reinforces ASEAN's commitment to marine environmental preservation and regional collaboration in addressing marine debris issues. It was proposed for consideration and endorsement by ASEAN leaders at the 34th ASEAN Summit in Bangkok, Thailand. The effort to promote cooperation in marine debris management among ASEAN member countries, negotiating partners and international organizations involves the execution of 2 key projects which are: Strengthening Capacity for Marine Debris Reduction in ASEAN Region through Formulation of National Action Plans for ASEAN Member States and Integrated Land-to-Sea Policy Approach (Phase 1) and the ASEAN Proposal on Marine Debris. Additionally, ASEAN collaborates under the Coordinating Body on the Seas of East Asia (COBSEA), an intergovernmental organization. Thailand is one of the 5 founding members that established COBSEA in 1981 to set policies and operational directions for maritime activities in the region. COBSEA promotes cooperation to protect marine environments and sustainably utilize marine and coastal resources. Currently, COBSEA has 10 member countries, comprising the Republic of Indonesia, Malaysia, the Republic of the Philippines, the Kingdom of Thailand, the People's Republic of China, the Republic of Korea, the Kingdom of Cambodia, the Socialist Republic of Vietnam, the Republic of Singapore and Australia. Following the COBSEA IGM 25.1 meeting, the COBSEA Secretariat introduced a preliminary draft of the TOR (Terms of Reference) for the East Asian Seas Regional Node of the Global Partnership on Marine Litter (GPML). This initiative stemmed from the joint efforts of various stakeholders and serves as a global mechanism to prevent and tackle problems related to marine litter and microplastics. It aims to share knowledge and find solutions to the issues of marine litter and microplastics, establish regional networks, promote regional participation and support the initiatives outlined in the COBSEA Regional Action Plan on Marine Litter (COBSEA RAP MALI). In Thailand, the Department of Marine and Coastal Resources is the central coordinating body for COBSEA activities. They have participated in endorsing the COBSEA Strategic Direction 2018-2022 regarding marine litter. This strategic direction aligns with the United Nations General Assembly's resolution on "Transforming Our World: The 2030 Agenda for Sustainable Development", with a focus on SDG 14, which highlights the sustainable use of oceans and marine resources to guide operations. The aforementioned strategy acts as a framework for implementing initiatives geared towards safeguarding the marine environment in the East Asian region for a five-year period (2019-2022). It received approval from COBSEA members during the Second

Extraordinary Intergovernmental Meeting of the Coordinating Body on the Sea of East Asia (EO-IGM-COBSEA) held on 25–26 April 2019. This strategy covers 2 main areas as follows: (1) Governance theme: It is mutually approved that COBSEA serves as a platform for exchanging experiences, policies and disseminating best practices to ensure efficient operations. (2) Substance theme: The core focus is on addressing land-based pollution as well as marine and coastal planning and management. Thailand has integrated the conservation, restoration and protection of marine ecosystems as well as the sustainable use of marine and coastal resources into its policies, plans and various cooperative frameworks. These endeavors encompass key aspects such as marine conservation areas, as stipulated in SDG 14, Sub-Goal 14.5, by the United Nations. By 2020, Thailand aims to conserve at least 10% of its marine and coastal areas in accordance with national and international laws, based on the best available scientific information, under Indicator 14.5.1, related to the scope of protected areas associated with marine ecosystems. Responsible agencies include Department of Marine and Coastal Resources, Department of National Parks, Wildlife and Plant Conservation, Office of Natural Resources and Environmental Policy and Planning and Department of Fisheries. In the course of operations, there have been declarations of marine resource protected areas incorporated into numerous plans and policies. For instance, Strategic Direction 5 of National Strategy 2018-2037 aims to foster growth based on an environmentally friendly quality of life, with a sub-plan aimed at sustainable socio-economic development within the maritime sector. Issue (18) of Master Plan under National Strategy (2018-2037) focuses on sustainable growth and includes a sub-plan on sustainable socio-economic development within the maritime sector. Additionally, the National Reform Plans on Natural Resources and Environment emphasizes the management of marine protected areas and marine life. There are several plans in place, such as Thailand's ASEAN Environmental Action Plan 2018-2025 (revised edition, 2019) under Strategy 2 regarding marine and coastal environment, the Marine and Coastal Resource Management Promotion Act 2015, the Fisheries Act 2015, the National Parks Act 2019 and the Enhancement and Conservation of the National Environmental Quality Act 1992 which designates areas for environmental conservation through authorities conferred under Articles 43-45. Efforts to effectively and sustainably utilize marine and coastal resources have led government bodies and related agencies to develop plans and policies as well as engage in various agreements. For example, the Promotion of Coastal and Marine Resource Management Act provides guidelines for managing, conserving and restoring marine and coastal resources as well as preventing coastal erosion. National Strategy 2018-2037, Strategic Direction 5 regarding fostering growth based on an environmentally friendly quality of life, Issue 2 regarding sustainable socio-economic growth within the maritime sector, focuses on promoting the country's growth through a variety of maritime activities while ensuring comprehensive management of marine and coastal resources. Issue (18) of Master Plan under National Strategy (2018-2037) focuses on sustainable growth with a sub-plan regarding building sustainable socio-economic growth within the maritime sector. Under the 13th National Economic and

Social Development Plan (2023-2027), Milestone 10 regarding Thailand establishing a circular economy and a low-carbon society, Strategy 3 focuses on the restoration of natural resources and enhancing the efficiency of resource utilization based on the Sufficiency Economy Philosophy. Furthermore, Milestone 11 states that Thailand is able to reduce risks and impacts from natural disasters and climate change. Under Strategy 4, the emphasis lies on the preservation and rehabilitation of natural resources and ecosystems to prevent and mitigate the impacts of natural disasters and climate change. Reform Activity 2 under the National Reform Plan (revised edition) focuses on the management of marine and coastal areas at the provincial level. The 1st Policy under the Enhancement and Conservation of National Environmental Quality 2017-2037 focuses on the management of natural resource base for equilibrium, fairness and sustainability. Strategy 1 under the Comprehensive National Park Master Plan 2017-2021 focuses on resource protection. The National Maritime Security Plan (2015-2021) serves as the primary framework for supporting operations of governmental bodies and relevant sectors with an aim to create collaborations in safeguarding and conserving marine resources to uphold the nation's maritime benefits. The Comprehensive Biodiversity Management Master Plan 2015-2021 and Strategy 2 under the Biodiversity Management Operational Plan 2017-2022 regarding the conservation and restoration of biodiversity. Strategy 2 under the ASEAN Environmental Action Plan of Thailand 2018-2025 (revised edition) regarding marine and coastal environments and Strategy 1 under the Thailand Development Acceleration Strategy using the BCG Economic Model 2021-2026 regarding creating sustainability for resource base and biodiversity by balancing conservation and utilization. The planning and utilization of maritime areas, integrated into SDG 14, Sub-Goal 14.2, regarding sustainable management and protection of marine and coastal ecosystems, suggests that management should follow the ecological approach while using maritime areas as an indicator of progress towards the goals. Thailand's operations involve incorporating the aspect of marine and coastal resource utilization zoning under the concept of Marine Spatial Planning has been incorporated into several strategies and policies, including the National Reform Plan (revised edition) under Reform Activity 2 focusing on the governance marine and coastal zones by province and Thailand ASEAN Environmental Operation Plan 2018-2025 (revised edition 2019). It is also included in national policies, plans and projects on the conservation and restoration of important marine and coastal ecosystems. Department of Marine and Coastal Resources, under Ministry of Natural Resources and Environment, provided an update on the situation of marine and coastal resources and coastal erosion in Thailand in 2021. It was found that coral reefs covered 149,183 rai and are in a generally healthy state, with conditions improving when compared to 2020. Mangrove forest areas were trending towards an increase in both area and health status. The condition of Seagrass resources was improving. Furthermore, there was a positive shift in the reduction of marine debris. Despite these improvements, there remain critical challenges that require continuous action including the overexploitation of marine life, the destruction of mangrove forests and the loss of rare marine species. Efforts to rehabilitate

marine resources are underway, guided by several strategic and policy frameworks. For instance, National Strategy 2018-2037, under Strategic Direction 5, focuses on fostering growth based on an environmentally friendly quality of life with a sub-plan for sustainable growth within the maritime economic sector; Master Plan under National Strategy (2018-2037), Issue (18), addresses sustainable growth within the sub-plan emphasizing the sustainable socio-economic growth within the maritime sector; and Master Plan for Marine and Coastal Resource Management 2017-2036, under Strategy 1, which focuses on forest management and biodiversity, aims to enhance the health of coral reefs, seagrass beds and marine ecosystems. Acknowledging the problem of pollution in marine and coastal areas and its detrimental effects on marine ecosystems, Thailand has taken steps towards managing the pollution affecting its marine and coastal resources. The goal is to preserve the sustainability of marine ecosystems and natural resources. This involves a coordinated approach among various agencies through the implementation of relevant policies and plans. For instance, actions are undertaken in alignment with SDG 14, under Sub-Goal 14.1, which aims for a significant prevention and reduction of marine pollution of all forms, especially those originating from land-based activities, including marine debris and nutrient pollution, by 2025. This objective is being pursued through several organizational plans, including the 20-Year Pollution Management Strategy and the Pollution Management Plan 2017-2021 by Pollution Control Department as well as the National Plan for the Prevention and Elimination of Water Pollution by Oil Spill from the Marine Department.

1. Development Agenda: The development of a nation leads to the expansion of its economy, industry, tourism as well as government economic stimulus policies. Additionally, an increasing population results in the continuous exploitation of marine and coastal resources in various ways, such as a providing food for humans, serving as habitats for marine animals and generating economic value. Consequently, this leads to numerous impacts, including the degradation of resources, conflicts over coastal land use, severe coastal erosion and a significant decrease in the quantity of marine life caught. Therefore, it is crucial to conserve and restore marine ecosystems to enhance their capacity for sustainable use of marine and coastal resources, in line with the set objectives under the strategic framework. This involves addressing significant development issues as follows:

Marine and coastal resource conservation areas: Areas declared as marine and coastal conservation areas in Thailand are designated for maintenance, conservation, restoration and sustainable use of marine and coastal resources. The objective is to protect and preserve the natural state, environment and biodiversity in a pristine and healthy condition. These zones include crucial coral reefs and habitats for rare species. They are recognized for their biodiversity and complete ecosystems, although their natural characteristics may be fragile and vulnerable to damage from human activities, such as tourism and fisheries. Therefore, protective measures will be established for marine and coastal resource conservation areas in order to preserve their natural state, serving as habitats and

breeding grounds for corals and rare marine species, while also promote sustainable use. Over the past several decades of safeguarding Thailand's marine and coastal resources, there has been a noticeable increase in the areas designated for marine conservation. Currently, there is a total of 15,712 square kilometers (excluding overlapping areas) of marine protected areas, accounting for about 4.86% of Thailand's total maritime area. Related agencies have continuously carried out various operations to promote the conservation of marine and coastal resources. In 2021, Department of Marine and Coastal Resources announced in the Royal Gazette the designation of new marine and coastal conservation areas, adding 2 areas totaling 375 square kilometers. These include the Mu Koh Kra in Nakhon Si Thammarat Province, covering 229 square kilometers, announced on 28 May 2021 and Koh Losin in Pattani Province, covering 146 square kilometers, announced on 31 March 2022. In addition, there are 12 marine and coastal resource conservation areas that have been approved by the National Marine and Coastal Resource Management Policy and Planning Committee, covering an overall area of approximately 2,636 square kilometers. The past efforts to establish and expand the coverage of marine and coastal conservation areas have encountered challenges and deficiencies, including the representation of these protected zones. To achieve systematic and sustainable management of marine and coastal conservation areas, it is imperative that government agencies, the private sector and the public collaborate in an integrated manner to protect and conserve marine and coastal natural resources and to ensure their sustainable use.

Coastal zones are appropriately managed: Thailand is home to 23 coastal provinces, including 6 provinces along the Andaman Sea and 17 provinces on the Gulf of Thailand. The total coastal regions of the country extend over 255,072.75 square kilometers. The Eastern region accounts for 22,423 square meters, the Central region covers 16,454.64 square kilometers and the Southern region spans 66,195.11 square kilometers. Coastal areas are the regions where land meets the sea. Influenced by both land and sea, these areas naturally undergo constant changes, most of which recover or return to equilibrium on their own. Coastal zones are recognized for their high development potential and opportunities, as well as being rich in valuable natural resources and diverse ecosystems. Coastal areas play important roles in providing habitats for various organisms, breeding and nesting grounds for marine life, destinations for natural tourism, sources of food and fishing and facilitate environmental education and research. At present, coastal areas are subject to diverse uses and activities. Both human actions and natural disasters have led to the disturbance of natural habitats, a decrease in available food sources and a reduction in spaces for habitation and egg-laying, which in turn escalates death rates among wildlife. Therefore, the impacts stemming from various activities pose significant threats, resulting in numeral adverse effects. Therefore, stakeholders from all sectors, including government, private sector and local communities, have acknowledged the need for maintenance, conservation and rehabilitation of coastal regions. They aim to address ongoing issues through the implementation of resource

management plans, projects and activities targeting marine and coastal zones, with the goal of achieving proper management of coastal areas as described below:

Coastal erosion: In 2020, Thailand's coastline extended across 23 provinces, totaling 3,151.13 kilometers in length. Of this, the Gulf of Thailand coastline accounted for 2,039.78 kilometers while the Andaman Sea coastline was 1,111.35 kilometers. Today's exploitation of marine and coastal resources, coupled with economic growth, has led to permanent changes in coastal areas, exacerbating natural changes to a degree where restoring balance becomes impossible. The main cause of coastal erosion stems from the imbalance in sediment distribution along the coastline, often resulting from human activities. Such actions disrupt the natural ecosystem, leading to ongoing adverse impacts in surrounding areas.

Coastal erosion is more pronounced along the Gulf of Thailand compared to the Andaman Sea, with some Gulf regions witnessing an escalation in erosion intensity. Notably, in provinces like Chanthaburi, Rayong, Chachoengsao and Samut Prakan, erosion rates surpass 5 meters annually. The primary causes of this erosion include wave, wind, storms, flooding or the influence of local biological activities. Waves are a key factor in altering the characteristics of coastal sand and sediments, with human actions exacerbating coastal erosion. Examples include the development of deep-sea ports, reclaiming land for construction projects, building hotels and accommodations that invade coastal sand dunes, constructing dams, weirs or upstream reservoirs, encroaching and destroying mangrove areas for aquafarming, extracting groundwater and impacts of global climate change, which lead to sea level rise. Tackling the issue of coastal erosion requires comprehensive research, planning and understanding of both natural processes and human exploitation of marine and coastal resources. Such measures ensure systematic and sustainable solutions to coastal erosion problems. Department of Marine and Coastal Resources is engaged in tracking and evaluating the Ocean Health Index, emphasizing the assessment of the ocean's ability to provide essential benefits to humans, which is under the coastal protection issue. Furthermore, initiatives to counteract coastal erosion include the development of coastal protection measures classified into white, green and gray strategies. This effort is complemented by compiling academic data for systematic management of coastal areas, the erection of bamboo barriers to reduce wave impact across 13 provinces with a combined length of more than 103 kilometers (2007-2022) and mangrove reforestation in 19 provinces.

Marine and coastal area utilization planning: Marine and coastal areas are vital for the economic and social systems. However, their management often lacks efficiency due to several factors which are the absence of integrated collaborative efforts, conflicts and overlaps in roles and responsibilities and the serious lack of law enforcement. These are key reasons leading to the degradation of marine and coastal resources. Effective management of marine and coastal areas, with a focus on economic, social and environmental goals, can foster an ecological balance. This supports biodiversity, serves as food source, tourism destinations, energy resources, recreational activities and other uses. Moreover, proper management can

resolve conflicts using precise and unified data in the future. Therefore, the Marine Spatial Planning Programme has been established by the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO). This initiative aims to assist nations in identifying areas for biodiversity, conservation and sustainable economic development within marine territories based on an ecosystem-based management approach. This program aims to improve the efficiency and effectiveness of marine and coastal area management, ultimately reducing costs compared to uncoordinated sectoral management efforts. Department of Marine and Coastal Resources has conducted studies and pilot projects on zoning for the utilization of marine and coastal resources based on the concept of Marine Spatial Planning. This process involved collecting data, problematic issues and the scope of authority of relevant agencies to tailor spatial planning appropriately. Efforts were also focused on evaluating and synthesizing data (current and future trends) across 3 locations including Koh Sichang in Chon Buri Province, the area of Phang Nga Bay encompassing Phang Nga, Krabi and Phuket provinces, and Koh Phayam in Ranong Province. The project also involved creating the Ocean Account and drafting resource maps and resource utilization maps

Important marine and coastal ecosystems: Thailand's marine and coastal resources represent a wealth of ecological diversity with abundant life forms within their ecosystems. At present, the management and preservation of natural resources and the environment involve interconnected relationships among living organisms in both terrestrial and marine ecosystems. The positive outcomes of conserving and restoring one ecosystem will benefit another, creating interlinked systems that maintain their richness. This ensures the sustainable use of these resources for future generations. Nevertheless, marine and coastal ecosystems are still subject to both direct and indirect impacts from human actions and natural phenomena. As such, they must be continuously conserved and restored. In driving towards the Sustainable Development Goal (SDG) 14, which focuses on the conservation and sustainable use of the ocean and sea resources for sustainable development, under Sub-Goal 14.2, emphasizes the sustainable management and protection of marine and coastal ecosystems by 2020. The following marine ecosystems have been prioritized for management implementation:

- **Corals:** Coral reefs are complex ecosystems with high biodiversity. This is because they serve as habitats and refuges for marine life throughout their life cycle. Therefore, coral reefs are vital for supplying food, support fisheries and function as natural marine mechanisms. They are the origin of sand and also significant tourist destinations that play a substantial role in boosting the economy of local communities and the nation at large. However, the exploitation through various activities has resulted in significant direct and indirect negative impacts on coral reef ecosystems, causing substantial degradation. This damage disrupts the balance of marine ecosystems, risking further degradation and loss. The coral reef situation in Thailand is showing signs of improvement, with the area of coral reefs in 17 provinces increasing by 0.05% from 2015. The condition ranges from severely

damaged to excellently preserved. However, the degradation and natural loss of coral reefs in provinces such as Surat Thani, Phang Nga and Trat remain urgent issues that need serious attention. This is because they affect the balance of marine ecosystems and resources, leading to the loss of biodiversity and a decline in economically important marine and coastal species. Consequently, this diminishes the overall marine and coastal resource base, potentially resulting in overexploitation beyond natural capacities, competition for scarce resources and disparities in resources accessibility. In past efforts to restore and conserve coral reefs, relevant agencies have deployed artificial reefs, enhancing the biodiversity of the ecosystems over an area of 123,000 square meters. This initiative has led to increased marine productivity, boosting the income of local communities from fisheries and tourism. Nonetheless, it is essential to conduct research on the implementation of artificial reefs since improperly positioned artificial reefs can lead to problems and impacts on both the ecosystems and marine and coastal resources. Department of Marine and Coastal Resources has implemented various measures to promote the sustainable conservation of coral reefs. These include projects to assess the condition of coral resources, evaluate the situation of coral bleaching in response to climate change, and initiatives for the integrated restoration of coral resources by all sectors. Actions have been taken to rehabilitate corals using the Coral Propagation method in areas like Maya Bay in Hat Noppharat Thara–Mu Koh Phi Phi National Park, with ongoing surveys and monitoring of coral status in these regions. Additionally, efforts are made to replace corals that have died. Surveys of the coral condition in these areas have shown a trend towards an increase in the percentage of living coral cover.

- **Mangrove forests:** Mangrove ecosystems are composed primarily of evergreen trees that share similar ecological characteristics and structural adaptations. The distribution of plant species in mangrove forests is determined by tidal zones, which differ from terrestrial forest plant communities. This is due to the influence of soil properties, the salinity of seawater and tidal fluctuations, which are crucial for the distinct zones of mangrove forests. These plants have evolved to withstand saline conditions. Therefore, mangrove ecosystems act as the first line of defense between land and sea, comprising diverse species of plants and animals, as well as various other environmental elements, as part of a system. This includes the tidal movements, the organically rich mangrove soil and the overall condition of the mangrove areas. Based on the satellite imagery analysis by Department of Marine and Coastal Resources in collaboration with the Geo-Informatics and Space Technology Development Agency (Public Organization) in 2020, it was found that Thailand's mangrove areas were distributed along the eastern, central, and southern coastal regions, covering 24 provinces. The total area of preserved mangrove forests was approximately 1,737,020 rai. Over the 10-year period from 2012 to 2021, there has been a continuous increase in the area of mangrove forests, with the latest data in 2020 showing an expansion. The reasons for the yearly increase in mangrove areas include government measures to prevent encroachment and destruction, efforts to reclaim mangrove areas, and the reforestation of reclaimed areas. Additionally, campaigns to

support and promote awareness for the conservation of forest resources have contributed to the increase in mangrove forest areas. In 2022, Department of Marine and Coastal Resources reported on the progress of projects aimed at the maintenance and restoration of mangrove forests, such as the mangrove reforestation project, which accomplished the planting of 2,590 rai of mangroves. The project to enhance the efficiency of protecting and preserving mangrove resources included the following operations: 1) The integrated reclaiming (restoration) of mangrove areas conducted in several provinces, including Krabi, Chanthaburi, Chumphon, Trang, Trat, Nakhon Si Thammarat, Prachuap Khiri Khan, Pattani, Phang Nga, Phuket, Ranong, Rayong, Songkhla, Satun, and Samut Prakan, with a total of 106 cases, involving 59 suspects and an encroached area totaling 2,843.13 rai. 2) The removal and destruction of encroaching crops in reclaimed areas were carried out over an area of 5,526.48 rai, aiming to clear the way for future mangrove forest rehabilitation and reforestation. Lastly, 3) Patrol and protection of mangrove forests were conducted in the provinces of Surat Thani, Samut Songkhram, Phetchaburi, Prachuap Khiri Khan, Ranong, Phang Nga, Trang, Satun, Rayong, Chanthaburi, Trat, Chon Buri, Chachoengsao, Samut Prakan, Chumphon, Songkhla, Nakhon Si Thammarat, Pattani, Krabi, and Phuket, totaling 1,854 patrols covering a distance of 26,545.40 kilometers.

- **Seagrasses:** Seagrasses are a crucial marine ecosystem as they provide nursery habitats, spawning grounds and rich feeding areas for marine and economically important aquatic species, including shrimp, shellfish, crabs and fish. These organisms spend parts of their life cycles within the seagrass ecosystem. Additionally, seagrass beds are vital habitats and food sources for rare and endangered marine animals, such as dugongs and sea turtles. They also hold economic importance through their role in supporting essential fishing activities for coastal communities. In Thailand, seagrass beds thrive in shallow coastal waters and are found in various forms across different areas, such as brackish water near estuaries, shallow coastlines with sandy and muddy bottoms, or intermingled with coral reefs. In 2020, the potential areas for seagrass beds covered approximately 160,628 rai across 17 coastal provinces. Department of Marine and Coastal Resources has conducted surveys and monitoring of seagrass bed conditions and found that the area of seagrass beds in 19 provinces increased by 7.91% from 2015, with conditions being very good to excellent, particularly in Trat and Chon Buri Provinces. However, in certain areas near shipping routes, industrial zones, tourist spots and large coastal settlements, there is noticeable deterioration in the seagrass ecosystem and resources, impacting biodiversity. In response, Department of Marine and Coastal Resources has implemented integrated seagrass restoration projects, involving all related sectors and delegating responsibilities to various agencies for appropriate action in affected areas.

- **Pollution impacting marine resources:** Marine and coastal pollution arises from the discharge of various pollutants into the sea and coastal areas, causing impacts on the environment, living organisms and marine plants and animals. This results in the degradation of the quality of the marine and coastal environment. Currently, the problem of marine pollution is becoming more severe, with notable sources including solid waste, community

wastewater and oil spills. The impacts of this pollution are interconnected, affecting ecosystems, food sources, fisheries, the economy and tourism. Progressing towards SDGs) requires the involvement of multiple sectors and addressing the root causes of issues by efficiently managing land-based waste and pollution. This approach aims to reduce the volume of marine debris and the occurrence of eutrophication, which have detrimental impacts on marine life and the balance of marine ecosystems. In this regard, relevant agencies have undertaken initiatives and voluntarily committed to protecting Thailand's marine environment through various policies and plans. For example, Pollution Control Department has developed the 20-Year Pollution Management Strategy and the Pollution Management Plan 2017-2021, as well as the National Solid Waste Management Master Plan (2016-2021), aiming to reduce marine pollution and manage nutrient pollutants originating from terrestrial sources. Efforts also address marine pollution from litter and waste, and the removal of oil spills. Department of Marine and Coastal Resources reported the Ocean Health Index (OHI) scores for Thailand in 2021. Thailand scored 72 out of 100, which is above the global average score of 70. Thailand ranked 79th out of 221 Exclusive Economic Zones (EEZs). Significant marine and coastal pollution issues are as follows:

- **Marine debris:** Global attention is currently drawn to the challenges of marine debris and microplastic contamination in oceans worldwide, detectable at every ocean depth. The Stemming the Tide: Land-based strategies for a plastic-free ocean report conducted by the Ocean Conservancy, a nonprofit organization instrumental in shaping ocean-related policies at both the federal and local government levels, based on scientific academic journal processes in partnership with the McKinsey Center for Business and Environment in 2015, highlights that over 8 million tons of plastic waste are deposited into the global seas and oceans each year. More than 50% of this marine debris originates from Asian countries, including China and ASEAN countries such as Indonesia, the Philippines, Vietnam, Thailand, Malaysia and Myanmar. Indonesia, in particular, struggles with marine plastic pollution, causing several of its rivers, including the Brantas, Solo, Serayu and Progo, to be listed among the top 20 most polluted rivers in the world. The World Economic Forum has forecasted that without proper waste management and a shift in plastic consumption habits by 2050, the amount of plastic in the oceans will exceed the total fish population. This situation will not only impact the environment and marine ecosystems but will also affect human livelihoods and national economies. The data underscores the increasingly alarming situation of plastic waste in the region's oceans. Marine debris ranks as a top concern for Thailand, with ineffective management of both land-based and marine waste contributing to the degradation of the marine environment. This deterioration affects the ecosystem and marine and coastal resources, human health, and other living organisms, as well as the economy, society, and tourism. Furthermore, the proliferation of microplastics in the marine environment has led to their accumulation in the food chain, with the potential to move up through the levels of food consumption within ecosystems. This poses a threat to the health and livelihood of living

organisms, prompting the implementation of significant measures for marine waste management. For instance, Department of Marine and Coastal Resources has initiated various measures such as the removal of accumulated marine debris from marine ecosystems, launching campaigns for waste management and smoke-free beaches, conducting research on microplastics, and developing and installing trash collection barriers at 23 locations in 15 coastal provinces. These efforts are expected to intercept more than 10,000 kilograms of litter before it reaches the Thai seas. Department of National Parks, Wildlife and Plant Conservation has collected data on marine debris in 26 national marine parks, categorizing it into debris found on beaches, at the water's surface, and in coral reef zones. Meanwhile, Department of Environmental Quality Promotion has implemented projects aimed at fostering discipline and participation in waste management and environmental sustainability among the nation's populace. These initiatives aim to enhance public awareness and understanding of managing waste at its source, reducing community waste, and promoting practices of reuse and recycling in line with the 3Rs principle (Reduce, Reuse, Recycle) through media and activities that engage all target groups. Consequently, the collaborative efforts of these agencies are leading to a noticeable improvement in the reduction of marine debris.

- **Marine and coastal water quality:** Thailand's marine water is categorized into 6 quality types: (1) Marine water quality for the conservation of natural resources, which includes marine waters not designated for any specific use. These areas are natural marine habitats important for the reproduction or nursery grounds for young marine life and serve as feeding grounds or habitats for marine animals, plants, or seagrasses. (2) Marine water quality for the conservation of coral reefs, which encompasses marine areas with coral reefs. The boundaries extend horizontally from the water's surface, starting from a straight line drawn perpendicular to the line connecting the outermost points of the coral reef, covering an area within a 1,000-meter radius. (3) Marine water quality for aquaculture includes marine areas designated as aquaculture zones under fisheries law. (4) Marine water quality for recreational use includes marine areas that local governing bodies have declared as zones for swimming or water-based recreational activities. (5) Marine water quality for industrial and harbor purposes covers marine areas adjacent to industrial estates as defined by the laws governing industrial estates in Thailand, industrial operation zones as per the Factory Act and port zones under the Thai maritime navigation law, including ports and docking stations as applicable. The boundary extends from the lowest tide mark outward to a distance of 1,000 meters horizontally from the water's surface. (6) Marine water quality for community areas includes marine zones adjacent to communities officially designated as municipalities under the municipal law. This applies solely to the municipal territories of Pattaya City or Bangkok Metropolitan Area that are directly connected to the coastline. The designated area is defined from the lowest tide mark extending outward to a distance of 1,000 meters horizontally from the water's surface. The above classification of marine water quality is in accordance with the 27th announcement by the National Environment Board (2006), regarding the establishment of

marine water quality standards. For monitoring, inspecting, and evaluating the marine and coastal environment conditions, Department of Marine and Coastal Resources has conducted surveillance and assessment of marine water quality along the coastlines of the Gulf of Thailand and the Andaman Sea, covering a total of 248 stations. Upon reviewing the proportion of marine water quality against each criterion, it was found that in 2021, the majority of the marine water quality was categorized as good to excellent at 75%, fair at 22% and deteriorated at 3%. When examining the trend of changes in the quality of coastal marine water between 2014 and 2021, the average Marine Water Quality Index (MWQI) values each year indicate a slight trend in changes. Overall, the majority of marine water quality remained within the good category, followed by fair, excellent and deteriorated, respectively. The measured values show a comparison of changes from the previous year. Specifically, from 2020 to 2021, the percentage of marine water quality rated as good to excellent decreased from 76% to 75%, the fair category increased from 20% to 22%, and the deteriorated category decreased from 5% to 3%. The factors influencing the calculation of the MWQI include the high concentration of total coliform bacteria and high levels of nutrients, specifically nitrogen and phosphorus, in marine water.

- **Oil pollution:** The problem or impact of oil entering the sea can be traced back to multiple sources, all of which are linked to human activities. These activities include maritime operations involving the transfer of engine oil, oil transportation, offshore drilling for oil and natural gas and also maritime accidents such as collisions and sinkings. Oil pollution causes environmental impacts in the sea because oil and oil slicks covering the water surface hinder the exchange of oxygen between air and water, resulting in insufficient oxygen levels in the water. Marine life suffers from a lack of oxygen, and the oil also blocks sunlight from reaching underwater plants, affecting their ability to photosynthesize. When oil with high density sinks to the sea floor, it impacts the benthic animals. This clearly indicates that oil pollution has a significant impact on marine ecosystems, which in turn, has caused continuous damage to both the fishing industry and tourism. The severity and impact of oil spills in the sea and coastal regions of the Gulf of Thailand and the Andaman Sea differ based on several factors. These include the quantity and type of the spilled oil, the spill's origin, the geographical features of the area, the distance from the shore, the environmental conditions of the surrounding area, wave and wind conditions, tidal movements, wind speed and direction, temperature, duration of the spill and the number of floating debris. Through Department of Marine and Coastal Resources during the fiscal years of 2016-2020, in the coastal regions of the Gulf of Thailand and the Andaman Sea across 23 provinces, a total of 102 instances of oil spills were recorded. This tally includes 28 cases of oil spills and 74 instances of tar balls were found. During the fiscal year 2021 (1 October 2020 – 31 July 2021), there were a total of 44 oil spill incidents along the coastlines of the Gulf of Thailand and the Andaman Sea, comprising 17 oil spill events and 27 tar ball incidents. Recent monitoring and inspections of oil spill conditions in coastal provinces have revealed that oil spills occur more frequently

now than in the past. The causes include fishing and tourist boats, illegal cleaning of oil tanks and disposal of oil-contaminated water into the ocean, maritime transportation and unidentified sources. Additionally, oil leaks from offshore drilling rigs have led to tar balls being washed ashore which poses significant threats to the health of coastal ecosystems. To address the issue, relevant agencies have integrated plans and policies into setting various measures for the prevention and reduction of marine pollution due to oil spills.

- **Discoloration of marine water:** Eutrophication, a phenomenon resulting in the discoloration of marine water, often referred to as "Red Tide," is caused by the rapid growth of certain types of phytoplankton. This surge is primarily fueled by an excess of nutrients, especially nitrogen and phosphorus, under conducive environmental conditions. As a result, the color of the sea changes to reflect the predominant color of the abundant phytoplankton. The discoloration of seawater can significantly decrease the levels of dissolved oxygen (DO) in the water, falling to the point where aquatic life cannot survive. This reduction in oxygen can result from phytoplankton clogging the respiratory gills of aquatic animals as well as the decay of phytoplankton which leads to the deterioration of marine water. In 2021, the coastal regions of the Gulf of Thailand experienced 28 incidents of eutrophication, or changes in sea color, (an increase from 2020). Notably, Chon Buri Province witnessed 11 occurrences of this phenomenon from May to November. On the Andaman coast, there was a single instance of red algae bloom, belonging to the *Hypnea* genus, along with diatoms, at Patong Beach in Phuket Province. The discoloration of seawater in this region is attributed to several factors, such as the discharge of wastewater from residential areas and industrial plants, agricultural activities and the direct release of wastewater from coastal aquaculture into the water bodies.

2. Details of Strategies: The ecosystem and marine resource utilization strategy emphasizes the conservation and restoration of marine and coastal ecosystems as a whole. Management is conducted through effective mechanisms that adhere to international standards, enhancing measures to align with sustainable development goals. This includes reducing pollution and waste discharge into the sea, promoting efficient use of marine resources, and developing activities that are environmentally friendly. These activities encompass marine transportation, aquaculture, fishery, and eco-friendly tourism. Furthermore, the Strategy boosts involvement from relevant parties in management, both domestically and internationally. Its objective is to maintain and restore marine and coastal resources to a state of health and sustainability. This initiative underpins the nation's economic and social development in an eco-friendly manner. The Strategy is propelled by 2 key sub-strategies: Sub-strategy 2.1 focuses on the conservation, restoration and sustainable use of marine and coastal resources and ecosystems, and Sub-strategy 2.2 focuses on preparing for economic development based on sustainable use of marine and coastal resource base. The details are as follows:

Sub-strategy 2.1 Conservation, restoration, and utilization of marine and coastal resources and ecosystems: The sub-strategy emphasizes the conservation, restoration and

protection of marine and coastal resources and ecosystems, covering the seas, coastlines, mangrove forests, marine life and the surrounding environments of coastal regions and islands. It focuses on preventing the degradation of beaches, rocky shores and mangrove beaches by prioritizing marine and coastal resources, ecosystem conservation and restoration activities through protecting and restoring marine and coastal resources, mangrove forests and coastal ecosystems to achieve sustainability. It stresses the importance of community involvement in conserving and restoring marine and coastal resources and ecosystems and addresses the management of waste and pollutants released into the ocean. Moreover, it involves developing marine aquaculture practices that aligns with spatial marine utilization plans, creating knowledge and monitoring changes in the status of marine and coastal resources.

Sub-strategy 2.2 Preparedness to support sustainable marine and coastal resource-based economies: Enhancing the infrastructure, regulations, and developing the management systems for marine resources are key to supporting economic development based on sustainable use of marine and coastal resource base. It also aims to foster participation in management among stakeholders, both domestically and internationally, focusing on two main issues which are: (1) Structural and regulatory improvements are designed to accommodate economic development based on marine resource base, while also considering the limitations of resources that must be preserved for long-term utilization; and (2) Developing a management system for marine resources aimed at sustainable economic utilization. This involves activities to prepare for sustainable economic development based on marine and coastal resource base. Actions include establishing conservation areas to protect key ecosystems; discontinuing projects that harm the ecosystems; promoting the assessment of fishery resources; identifying and classifying coastal areas affected by erosion based on the severity and urgency of the problem; improving the design and construction standards of residential and industrial zones as well as infrastructure in coastal areas; and developing economic activities that consider environmental impacts and the benefits to the local population. Additionally, creating contingency plans for maritime crises that affect the quality of the marine environment, enables rapid and effective response and control of situations to address and mitigate issues.

Activities that support both sub-strategies to ensure the conservation, restoration and sustainability of marine and coastal resources include enforcing stringent measures to foster economic development while being mindful of resource limits. This encompasses revising laws, setting zones and criteria for the sustainable use of marine resources, defining roles, responsibilities and accountability of stakeholders. It also involves enhancing international cooperation in conservation and restoration efforts for marine and coastal ecosystems. Establishing laws to facilitate provincial zoning in maritime areas and promoting the country as a regional hub for maritime commerce are also key activities.

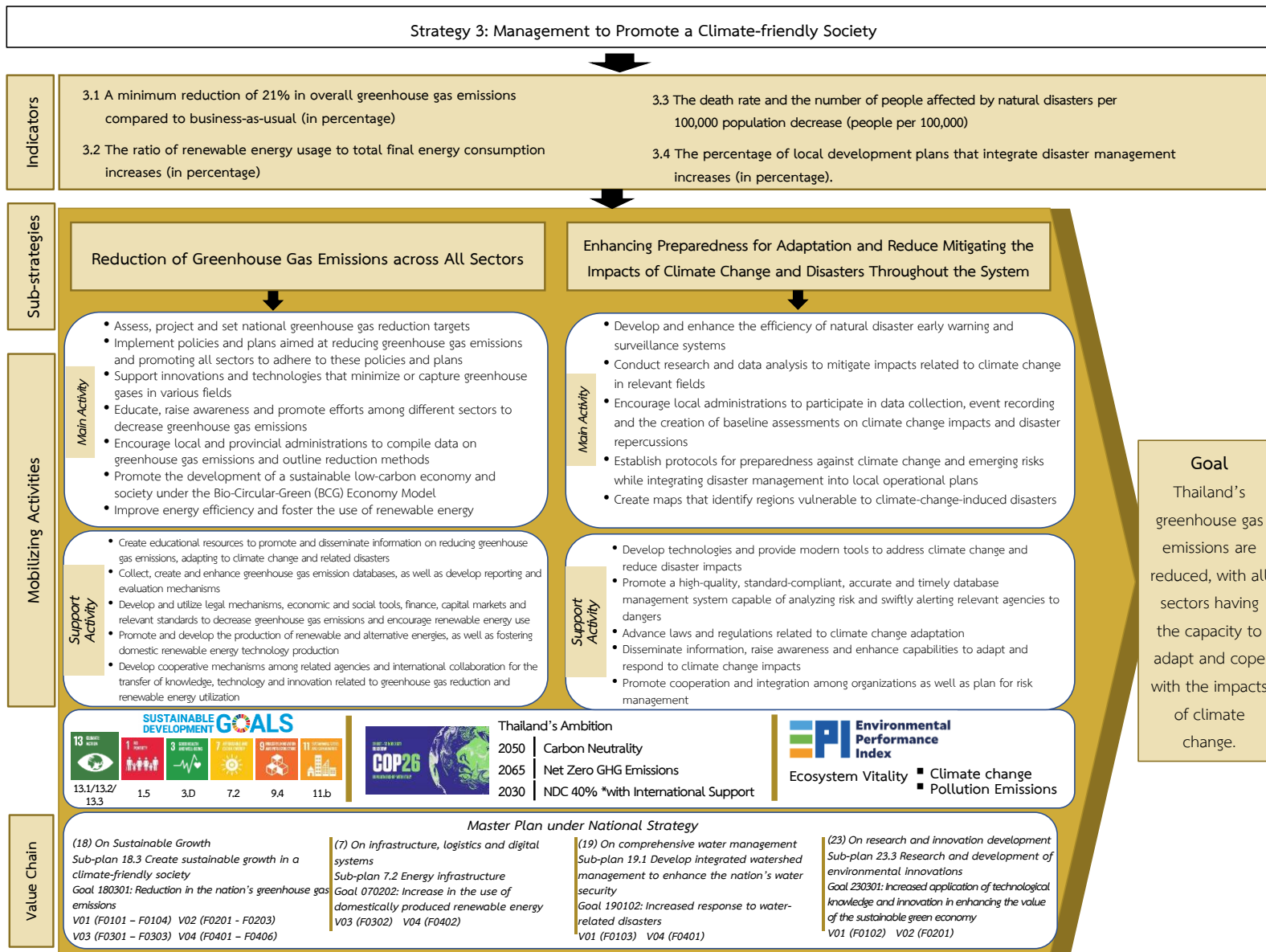


Figure 4: Strategy 3 Management to promote a climate-friendly society

Strategy 3: Management to promote a climate-friendly society

Goal: Thailand's greenhouse gas emissions are reduced, with all sectors having the capacity to adapt and cope with the impacts of climate change.

- Indicators:**
- 3.1 A minimum reduction of 21% in overall greenhouse gas emissions compared to business-as-usual (in percentage).
 - 3.2 The ratio of renewable energy usage to total final energy consumption increases (in percentage).
 - 3.3 The death rate and the number of people affected by natural disasters per 100,000 population decrease (people per 100,000).
 - 3.4 The percentage of local development plans that integrate disaster management increases (in percentage).

Climate change is expected to occur more rapidly and with greater severity. According to the Climate Change 2022: Mitigation of Climate Change report produced by the Intergovernmental Panel on Climate Change (IPCC), it is predicted that, without significant strengthening of policies beyond those in place as of 2020, greenhouse gas emissions will increase after 2025. This will cause the global temperature to rise by 3.2 degrees Celsius by 2100. As a result, various regions will face more frequent and severe climate volatility, including rising sea levels, melting glaciers and ice caps, decreased oxygen solubility and coral bleaching that leads to an imbalance in oceanic ecosystems and impacts food chains. Additionally, the situation will exacerbate severe natural calamities such as prolonged droughts, which in turn fuel severe wildfires, shorelines advancing inland, making lands more susceptible to storms and residential flooding, saltwater encroachment, persistent drought conditions or repeated flooding and the spread of seasonal diseases. Furthermore, it poses risks to food security and biodiversity, impacts economic and social conditions, and leads to an increase in poverty. The Organisation for Economic Co-operation and Development (OECD) estimates that the worldwide impacts of climate change could cost between 1.0% - 3.3% of the world's gross domestic product (GDP) by 2100. Without significant cuts in greenhouse gas emissions, the projected economic losses could escalate to 2.0%-10.0% of global GDP by 2150. For this reason, countries worldwide have become more attentive and aware of the impacts and damages caused by climate change. This has led to the inclusion of these concerns in key plans and policies, notably the Sustainable Development Goal 13 which calls for urgent action to combat climate change and its impacts, focusing on policies and mechanisms to support adaptation and response to climate change. Examples include enhancing resilience and the ability to adapt to climate-related hazards and natural disasters in all countries, incorporating climate change measures into national policies, strategies and planning, developing education, raising awareness, building capacity to address climate change challenges, adapting to changes, reducing impacts as well as implementing early warning systems. The United Nations Framework Convention on Climate Change (UNFCCC) represents a global collaboration aimed at addressing and mitigating the impacts of climate change, officially endorsed on 7 May 1992, and came into force on 21 March 1994. The Paris Agreement, a key development within

the framework of the UNFCCC, was established during the 21st Conference of the Parties to UNFCCC in Paris, in 2015. Its overarching goal is to hold the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit the global temperature increase to 1.5 degrees Celsius above pre-industrial levels. Climate change is a key issue addressed by various international agreements, including the Kyoto Protocol; the Vienna Convention and its Montreal Protocol, aimed at protecting the ozone layer; the United Nations Convention to Combat Desertification (UNCCD); the Sendai Framework for Disaster Risk Reduction 2015-2030; and the Global Methane Pledge. Additionally, the 26th Conference of the Parties (COP 26) to the United Nations Framework Convention on Climate Change, held in Glasgow, United Kingdom, in 2021, aimed to unite member countries in setting a course for global climate action. It served as a platform for world leaders to participate and express their determination or commitment to addressing climate change issues. The meeting focused on several key points including (1) establishing a cooperation mechanism for the transfer of carbon credits between countries, (2) defining a timeframe for the implementation of the Nationally Determined Contributions (NDC), (3) setting financial targets that developed countries must support developing countries to achieve climate change initiatives, (4) establishing a methodology for creating greenhouse gas (GHG) inventories and (5) reporting on the progress of implementing the Nationally Determined Contributions.

ASEAN region has prioritized issues related to climate change and disaster management, incorporating them into key strategic plans. These include the ASEAN Socio-Cultural Community Blueprint 2025, the ASEAN Strategic Plan on Environment 2016-2025, the ASEAN Agreement on Disaster Management and Emergency Response (ADDMER) and the ASEAN Declaration on ONE ASEAN, ONE RESPONSE: ASEAN Responding to Disasters as One in the Region and Outside the Region. Moreover, ASEAN has initiated several actions, such as the establishment of the ASEAN Centre for Climate Change, led by Brunei Darussalam when it chaired ASEAN in 2021. Efforts also include the development of the ASEAN State of Climate Change Report (ASCCR), the creation of regional mechanisms for disaster relief facilitated through the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre), and the implementation plan under the ASEAN Agreement on Disaster Management and Emergency Response (ADDMER Work Programme 2021 - 2025).

In addition, the combustion of fossil fuels for energy production results in significant greenhouse gas emissions into the atmosphere, which is a major contributor to global warming and has a significant impact on climate change. According to the International Energy Outlook 2021, global energy consumption is projected to increase by about 50% by 2050 when compared to 2020. However, the finite nature of fossil fuel resources is causing severe global fuel shortages, resulting in continuous price increases. This situation, combined with concerns over greenhouse gas emissions, is driving a worldwide shift towards adopting renewable energy alternatives. The International Energy Agency (IEA) reported a 3% rise in global renewable energy consumption in 2020. Actions have been taken through various collaborative efforts to

increase the use of renewable energy instead of fossil fuels, aiming to reduce greenhouse gas emissions. This includes initiatives such as the ASEAN Ministers on Energy Meeting (AMEM) and Associated Meetings, as well as the development of the ASEAN Plan of Action for Energy Cooperation 2021-2025 (APAEC Phase II).

In 2018, Thailand reported in its Fourth National Communication that the country's net greenhouse gas emissions from various activities amounted to 286,680.53 Giga grams of carbon dioxide equivalent (GgCO₂eq). The energy sector was responsible for the largest share of emissions, contributing 257,340.89 GgCO₂eq, which accounts for 69.06% of the total emissions, followed by the agricultural, industrial process, and waste management sectors, respectively. Like the rest of the world, Thailand has felt the impact of climate change, with a noticeable increase in its average annual temperature over the last decade. Data from Meteorological Department of Thailand indicates that, from 2018 to 2021, the country's average annual temperatures were recorded at 27.5, 28.1, 28.0, and 27.5 degrees Celsius, respectively. These figures are higher than the normal average temperature of 27.1 degrees Celsius recorded over the 30-year period from 1981 to 2010. In 2021, Thailand experienced higher than average annual rainfall and the average sea surface temperatures in the central and eastern areas of the equatorial Pacific Ocean were below normal, indicating a La Niña event. These conditions led to frequent and severe natural disasters, including floods, droughts and storms, resulting in fatalities and significant damage to the economy and resource management. Moreover, Thailand's growing population, economic advancements transitioning into the digital era and the push for Thailand 4.0 policy have led to higher energy consumption. The rising trend in automotive technology emphasizes the future significance of electric power, potentially influencing the development of biofuels in the transportation sector. Furthermore, the availability of modern technologies at lower costs has prompted a behavioral shift among energy users towards more self-generation of energy and greater participation in energy trading. However, Thailand still relies on energy imports from abroad. Therefore, the production of renewable energy represents a way to convert the country's natural energy potential into alternative sources to power the economy. This approach can partially reduce dependence on international energy sources and stimulate investment in renewable energy as an additional benefit.

Thailand has acknowledged the importance of managing initiatives to foster a climate-friendly society. Within the national context, key issues related to climate change include reducing greenhouse gas emissions, adapting to the impacts of climate change and natural disasters and adopting renewable energy. These 3 critical points have been integrated into three-tiered planning: The Level 1 plan is National Strategy 2018-2037, under Strategic Direction 5 focusing on developing growth on an environmentally friendly quality of life and, under Issue 3, emphasizes sustainable growth within a climate-friendly society. The Level 2 plan includes Master Plan under National Strategy (2018-2037), directly addressing Issue (18) on sustainable growth (with a sub-plan for fostering sustainable growth in a climate-friendly society). It also connects with other Issues such as Issue (7) on infrastructure, logistics and digital systems (with

a sub-plan for energy infrastructure), Issue (19) on comprehensive water management (with a sub-plan for holistic watershed management to enhance national water security) and Issue (23) on research and development of innovations (with a sub-plan for environmental innovation development). The 13th National Economic and Social Development Plan (2023-2027) (Milestone 8 aims to establish safe, smart and sustainable living spaces and cities; Milestone 10 focuses on a circular economy and low-carbon society; and Milestone 11 is dedicated to minimizing the risks and impacts of natural disasters and climate change). Additionally, the National Security Policy (2019-2022) prioritizes, under the 12th Policy, enhancing energy and food security with a strong push towards using renewable energy. The Level 3 plans, such as the BCG Economic Model 2021-2025 under Strategy 3, seeks to elevate industrial development within the BCG economy for sustainable competitiveness. The Sustainable Production and Consumption Plan 2017-2040 (1st revision) (SCP Goal 4 aims to manage chemicals and all forms of waste throughout their lifecycles in an environmentally friendly way, in line with the already agreed-upon international cooperation framework. This includes minimizing the release of these substances into the air, water and soil to significantly lessen their negative impact on human health and the environment by 2037. Meanwhile, SCP 9 advocates for the advancement of scientific research, technology and innovation to support sustainable production and consumption. It further supports international collaboration to strengthen scientific and technological capabilities that will lead towards more sustainable production and consumption patterns). Thailand's ASEAN Environmental Action Plan 2018 - 2025 focuses on Strategy 5 regarding Climate Change, alongside the National Enhancement and Conservation of National Environmental Quality Policy and Planning 2017-2037 (the 2nd Policy within this framework promotes environmentally friendly development for prosperity and sustainability). This long-term vision has been integrated into the five-year Environmental Quality Management Plan.

Additionally, at the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 26 World Leaders Summit), Thailand's Prime Minister (General Prayut Chan-o-cha) expressed Thailand's intention to fully escalate its climate change mitigation efforts and through all available means. This commitment aimed at achieving carbon neutrality by 2050 and net-zero greenhouse gas emissions by 2065. Together with elevating its Nationally Determined Contributions (NDCs) to a 40% reduction with the aid of international support finance, technology, and national capacity enhancement by 2030, Thailand shows its dedication to transitioning into a low-carbon society. This preparation also signifies Thailand's proactive approach to comply with future international agreements and various environmental regulations, including the European Green Deal and the Carbon Border Adjustment Mechanism (CBAM).

1. Development Agenda: Considering the current situation along with objectives and strategies from a global to a national level, it is evident that climate change has worldwide effects, impacting Thailand in economic, social and environmental dimensions. Consequently,

Thailand must emphasize addressing factors influencing climate change as it plans to manage natural resources and the environment for the next 5 years. Important factors are as follows:

Greenhouse gas emissions: Countries around the world, including Thailand, have seriously committed to actions aimed at addressing climate change. Together, they have set targets for reducing greenhouse gas emissions during the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change Conference of the Parties (COP 26 World Leaders Summit). Thailand has established long-term goals and strategic frameworks to reduce the country's greenhouse gas emissions. These frameworks serve as guidelines for relevant agencies including Master Plan on Climate Change 2015 – 2050 and the National Greenhouse Gas Reduction Roadmap 2021 – 2030. Furthermore, the country is reviewing and updating its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) to align with the Prime Minister's statements, all coordinated by the Office of Natural Resources and Environmental Policy and Planning. This also includes elevating the greenhouse gas reduction target under the Nationally Determined Contribution (NDC) to 40%, with the provision of adequate international support in finance, technology and strengthening the nation's capabilities. Moreover, efforts have been made to boost the capacity for activities across all sectors that contribute to greenhouse gas reduction, through international collaboration both bilaterally and multilaterally. This involves implementing projects in areas where Thailand faces limitations, including knowledge, expertise, capability, technology and operational funding. Financial support, capacity enhancement and essential technology transfer are part of this effort. For instance, the Thai Rice NAMA (Nationally Appropriate Mitigation Action) project aims to support small-scale rice farmers in 6 central provinces — Chai Nat, Sing Buri, Ang Thong, Ayutthaya, Pathum Thani, and Suphan Buri — to access climate-smart agriculture technologies. This initiative seeks to improve rice production efficiency and transition to low-emission practices. This project has been actively pursued from 2018 to 2023. Additionally, efforts have been made to develop information systems and databases, such as the Thailand Greenhouse Gas Emission Inventory System (TGEIS) and the Thailand Climate Change Adaptation Information Platform (T-PLAT). Furthermore, related organizations, such as the Greenhouse Gas Management Organization (Public Organization), have implemented the Thailand Voluntary Emission Reduction Program (T-VER). This program aims to encourage and support voluntary participation from all sectors in reducing greenhouse gas emissions within the country, allowing for the sale of reduced emission quantities in the domestic voluntary carbon market. Additionally, the establishment of the Climate Action Academy (CAA) aims to enhance awareness regarding climate change and the Paris Agreement. It serves as a bridge facilitating the implementation of national policies into practical actions, enhancing capabilities, providing consultancy on greenhouse gas reduction for tangible actions, promoting involvement from all sectors and fostering a knowledge network on greenhouse gas management in efforts towards a low-carbon society.

Adaptation to climate change: Climate change is a primary cause of natural disasters, and Thailand has experienced a variety of such disasters. These include rising average

temperatures, higher sea levels, abnormal rainfall patterns that are either above or below normal in the same regions. This variability and unpredictability give rise to flooding and flash flooding, contributing to more frequent and severe occurrences of floods, droughts and storms. These natural disasters adversely affect the economy, society, natural resources and the environment, threaten national security and increase the mortality rate. Thailand's management of disaster risks adheres to international frameworks, including the Sustainable Development Goals (SDGs) under Goal 1 to end all forms of poverty, Goal 11 to make cities and human settlements inclusive, safe, resilient and sustainable and Goal 13 to take urgent action to combat climate change and its impacts. Additionally, the country follows the Sendai Framework for Disaster Risk Reduction 2015-2030 and the United Nations Framework Convention on Climate Change (UNFCCC) to guide its strategies and actions in this area. Thailand, through its relevant agencies, has formulated significant sector-specific plans and actions to prepare for and address these challenges. For instance, the National Climate Change Adaptation Plan, prepared by the Office of Natural Resources and Environmental Policy and Planning, serves as a framework and guideline for relevant sectors to integrate climate change adaptation measures into their sectoral and regional planning and strategies appropriately and efficiently. Thailand has also finite climate change adaptation projects supported by international funds. For instance, the Increasing Resilience to Climate Change Impacts in Marine and Coastal Areas Along the Gulf of Thailand project was funded by the Green Climate Fund (GCF). This initiative focuses on the integration of planning and financial allocation for climate change adaptation activities in marine and coastal areas, spanning from 2020-2024. Another notable example is the Strengthening Urban Climate Governance for Inclusive, Resilient, and Sustainable Societies in Thailand: SUCCESS project, supported by the European Union and implemented by the Thailand Environment Institute. This project is designed to enhance the knowledge base and academic skills of civil society in the provinces of Khon Kaen, Udon Thani, Nong Khai, Songkhla, Phatthalung and Satun. Its aim is to improve governance and adaptability to climate change, enabling significant stakeholders in the urban development process to achieve equality, equity, justice and climate adaptability. The project has been carried out from 2019 to 2024. In addition, under the Water Resources Act, B.E. 2561 (2018), a comprehensive water management plan covering all 22 river basins has been developed to unify and systematize the country's water resources management. This initiative, led by National Water Resources Office, ensures efficient water management throughout both the rainy and dry seasons. The development of the National Disaster Prevention and Mitigation Plan 2021 - 2027 by Department of Disaster Prevention and Mitigation aims to efficiently reduce existing risks and prevent new ones. This plan serves as a conceptual framework for agencies at all levels, from national to local, to prevent and mitigate disasters in a coordinated and unified manner. It emphasizes the importance of transforming the National Disaster Prevention and Mitigation Plan into various agency-level plans to ensure integrated efforts that are interconnected based on the roles and responsibilities of each agency. As a part of this strategic approach, local government organizations have formulated their operational plans for disaster

prevention and mitigation, which are critical for preparedness, alerting systems and providing assistance at the local level. Moreover, initiatives such as disaster prevention and mitigation training have been conducted to enhance operational efficiency. Efforts to improve public awareness and understanding of various hazards, as well as their prevention and mitigation, enable individuals to effectively address immediate challenges. These actions aim to minimize the risks and losses from disasters to both life and property, ensuring swift recovery and a return to normalcy. Furthermore, disseminating and sharing knowledge on disaster risk management raises awareness and promotes community involvement in preparing for possible future disasters.

Renewable energy: Economic growth and an increasing global population trend have led to higher energy consumption demands with fossil fuels playing an important role in meeting the world's energy needs. However, the limited supply of fossil fuels has led to a severe global energy crisis and continuously rising prices. Furthermore, the use of fossil fuels contributes significantly to greenhouse gas emissions, a primary cause of climate change and global warming. This situation has heightened global interest in finding sufficient, environmentally friendly energy sources. Currently, Thailand is moving towards a digital age, driving forward the Thailand 4.0 policy, alongside the burgeoning technology in the automotive sector. As a result, electricity is becoming increasingly vital, which could impact the development of biofuels in the transport sector. Moreover, there is a noticeable shift in consumer behavior towards becoming energy producers for personal consumption and for trading, further emphasizing the shift in energy dynamics. Thailand, through its Ministry of Energy, has developed the National Energy Plan by integrating 5 existing plans including: (1) Thailand's electricity generation development plan, (2) renewable and alternative energy development plan, (3) energy conservation plan, (4) natural gas management plan and (5) fuel management plan. This consolidated approach aims to guide key energy development areas such as electricity, natural gas, oil, renewable energy and energy conservation, under a unified framework. Furthermore, there are policies and plans in place that influence energy procurement and the promotion of energy production and consumption. Examples include the Cassava Strategy 2015-2026, the Sugar Cane Factory and Sugar Strategy 2015-2026, Ministry of Interior's announcement on Thailand's municipal waste management 2017, policies for purchasing electricity from renewable and alternative energy sources as well as initiatives promoting the use of electric vehicles, coupled with educating consumers on clean energy. Additionally, there are projects underway to foster energy conservation and the use of renewable energy, develop hydropower plants, encourage the management of community waste to create Refuse Derived Fuel (RDF) and push forward the development of Thailand's smart grid system.

2. Details of Strategies: Efforts to cultivate a society that is conducive to climate health emphasize the promotion of management practices to establish guidelines for reducing the nation's greenhouse gas emissions, ensuring compatibility with developments across economic, social and environmental dimensions. It also aims to build the readiness and

capacity to adapt to and deal with the impacts of climate change and related natural disasters comprehensively. This involves 2 sub-strategies:

Sub-strategy 3.1 Reduction of greenhouse gas emissions across all sectors:

Promoting management strategies to develop pathways for reducing Thailand's greenhouse gas emissions is crucial for ensuring alignment with the nation's economic, social and environmental growth while also advocating for the use of renewable energy. Key activities include assessing, projecting and setting national greenhouse gas reduction targets; implementing policies and plans aimed at reducing greenhouse gas emissions; encouraging all sectors to adhere to these policies and plans; supporting innovations and technologies that minimize or capture greenhouse gases in various fields; educating, raising awareness and promoting efforts among different sectors to decrease greenhouse gas emissions; encouraging local and provincial administrations to compile data on greenhouse gas emissions and outline reduction methods; promoting the development of a sustainable low-carbon economy and society under the Bio-Circular-Green (BCG) Economy Model; improving energy efficiency and fostering the use of renewable energy. Supporting actions include creating educational resources to promote and disseminate information on reducing greenhouse gas emissions, adapting to climate change and related disasters; collecting, creating and enhancing greenhouse gas emission databases, as well as developing reporting and evaluation mechanisms; and developing and utilizing legal mechanisms, economic and social tools, finance, capital markets and relevant standards to decrease greenhouse gas emissions and encourage renewable energy use. Additionally, it includes promoting and developing the production of renewable and alternative energies, as well as fostering domestic renewable energy technology production. Developing cooperative mechanisms among related agencies and international collaboration for the transfer of knowledge, technology and innovation related to greenhouse gas reduction and renewable energy utilization is also a part of this comprehensive sub-strategy.

Sub-strategy 3.2 Enhancing preparedness for adaptation and reduce mitigating the impacts of climate change and disasters throughout the system: This sub-strategy aims to promote effective data management in all sectors, establish operational plans and develop relevant technologies, surveillance systems and tools in order to enhance the ability to adapt and mitigate the impacts of climate change and disasters. Key activities include developing and enhancing the efficiency of natural disaster early warning and surveillance systems; conducting research and data analysis to mitigate impacts related to climate change in relevant fields; encouraging local administrations to participate in data collection, event recording and the creation of baseline assessments on climate change impacts and disaster repercussions; establishing protocols for preparedness against climate change and emerging risks, while integrating disaster management into local operational plans; and creating maps that identify regions vulnerable to climate-change-induced disasters. Supporting measures include developing technologies and providing modern tools to address climate change and reduce disaster impacts; promoting a high-quality, standard-compliant, accurate and timely database

management system capable of analyzing risk and swiftly alerting relevant agencies to dangers; advancing laws and regulations related to climate change adaptation; and disseminating information, raising awareness and enhancing capabilities to adapt and respond to climate change impacts. This also involves promoting cooperation and integration among organizations, as well as planning for risk management.

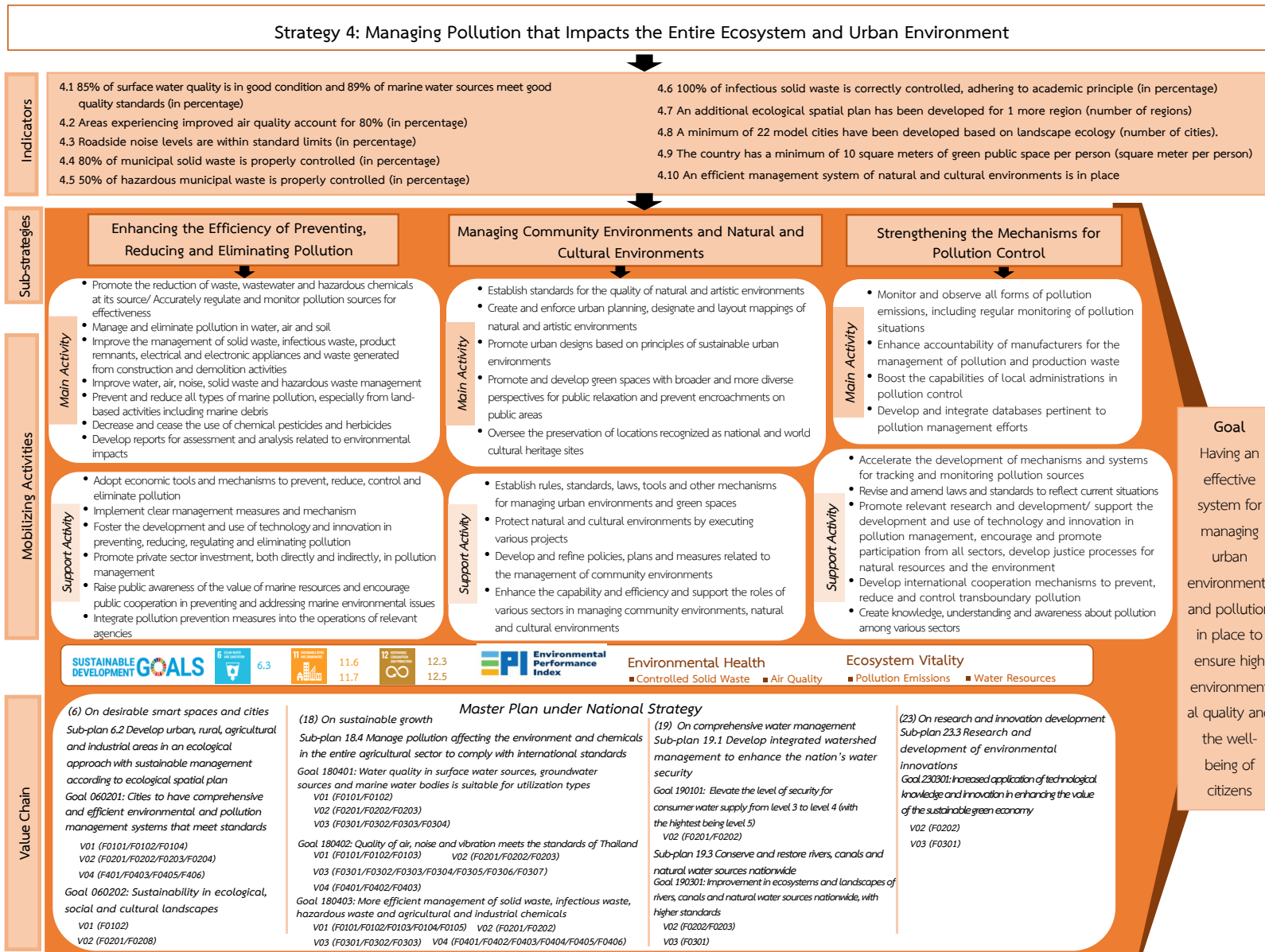


Figure 5: Strategy 4 Managing pollution that impacts the entire ecosystem and urban environment

Strategy 4: Managing pollution that impacts the entire ecosystem and urban environment

Goal: Having an effective system for managing urban environments and pollution in place to ensure high environmental quality and the well-being of citizens.

- Indicators:**
- 4.1 85% of surface water quality is in good condition and 89% of marine water sources meet good quality standards (in percentage).
 - 4.2 Areas experiencing improved air quality account for 80% (in percentage).
 - 4.3 Roadside noise levels are within standard limits (in percentage).
 - 4.4 80% of municipal solid waste is properly controlled (in percentage).
 - 4.5 50% of hazardous municipal waste is properly controlled (in percentage).
 - 4.6 100% of infectious solid waste is correctly controlled, adhering to academic principle (in percentage).
 - 4.7 An additional ecological spatial plan has been developed for 1 more region (number of regions).
 - 4.8 A minimum of 22 model cities have been developed based on landscape ecology (number of cities).
 - 4.9 The country has a minimum of 10 square meters of green public space per person (square meter per person).
 - 4.10 An efficient management system of natural and cultural environments is in place.

Managing urban environments and addressing pollution that affects the entire ecosystem are significant development issues for countries worldwide. The growth of the global economy stems largely from activities within major cities. Urbanization is thus one of the key emerging megatrends, with cities being economic hubs and attracting various investors to urban areas. This leads to migration into cities, which increases urban populations and density, creating a demand for land use that drives urban expansion. Sometimes urban expansion is not compatible with the characteristics of an area, such as urban expansion in areas unsuitable for settlement, areas with dense traffic, open burning areas and industrial parks. These situations lead to air and noise pollution. The discharge of industrial wastewater into natural water bodies impacts the lifecycle of organisms within ecosystems. Mismanaged waste from various activities, along with pollution from agricultural chemicals due to the continued import of chemical fertilizers and hazardous agricultural substances, contributes to environmental pollution. All these pollution issues have adverse effects on humans and other living beings. Furthermore, the population density in cities presents challenges in managing the urban environment. Issues include a lack of planning for balanced land use and natural ecosystem-based community environmental management. There is a shortage of green spaces and recreational areas, which is insufficient for the growing population. Additionally, there is a deterioration of natural and artistic environments. As a result, policies and agreements have been developed at international, regional and national levels to encourage and enhance the management of urban environments and the pollution that impacts the environment as a whole.

Many countries worldwide have prioritized urban environmental and pollution management as key areas for development, requiring proper and effective management to

ensure high environmental quality and a good quality of life for their citizens. Plans, policies, and various agreements have been established to prioritize the comprehensive management of urban environments and pollution. For example, the Sustainable Development Goals (SDGs), under Goal 11, focuses on making cities and human settlements that are inclusive, safe, resilient and sustainable. This goal encompasses several sub-goals including comprehensively enhancing urban development and capabilities for participatory planning and management of human settlements; reducing the negative environmental impacts of cities; focusing on air quality and management of solid waste and other types of waste; developing and providing access to green spaces for all communities; promoting participatory, integrated and sustainable urban and community management; and protecting and conserving the world's cultural and natural heritage. The Convention concerning the protection of the world cultural and natural heritage, or the World Heritage Convention, aims to enhance international cooperation in the protection, preservation and conservation of cultural and natural heritage sites located in various regions around the world. Its goal is to maintain their outstanding universal value as a legacy for all of humanity, both in the present and for future generations. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal aims to minimize the cross-border movement of hazardous waste by promoting environmentally friendly management practices. It encourages the treatment and disposal of hazardous waste as close to its source as possible and seeks to reduce the generation of such waste. Meanwhile, the Stockholm Convention on Persistent Organic Pollutants aims to protect human health and the environment from persistent organic pollutants (POPs) by reducing and eliminating the production, use, and release of these toxic substances. POPs are organic compounds that are resistant to degradation, highly toxic, bio-accumulative, persistent in the environment and can travel through air and water. The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC) aims to foster international cooperation and responsibility in the trade of certain hazardous chemicals and protecting human health and the environment from chemical hazards. It promotes the safe use of chemicals within environmental limits by facilitating the exchange of information about chemical properties. This allows the countries that are parties to the convention and national decision-makers to be informed about imports and exports.

ASEAN region is one of the regions in the world that are rich in natural resources. However, the population growth and the economic development have spurred rapid urbanization. Consequently, many cities are facing issues related to high population density and housing problems, which escalate into environmental challenges. These include water pollution (the quality of surface water, groundwater and seawater), air and noise pollution, the use of pesticides in agriculture and increased consumption that contributes to the rise in waste production. According to the Summary Report: Waste Management in ASEAN Countries under the United Nations Environment Programme (UNEP) in 2017, Indonesia generated the highest amount of waste annually at 64 million tons, followed by Thailand with 26.77 million tons. The majority of waste in ASEAN member countries was organic waste, accounting

for over 50% of the total. Additionally, solid waste such as plastics, paper and metals were commonly found, along with electronic waste, industrial waste and construction and demolition debris. Moreover, the increasing population density in urban areas leads to environmental degradation within cities. This includes a lack of adequate green and recreational spaces to meet the needs of the expanding population, as well as the deterioration of natural environments and artistic environments. These issues not only have a negative effect on the regional environment but also harm the quality of life for residents, both directly and indirectly. Therefore, strategic frameworks, policies and agreements such as the ASEAN Socio-Cultural Community (ASCC) Blueprint 2016-2025 have been established. This blueprint emphasizes fostering environmental sustainability, addressing global environmental issues without affecting competitive principles or socio-economic development. It supports the development of environmental technologies, the sustainability of freshwater resources and the improvement of living standards in ASEAN's urban and community areas. It also focuses on managing and preventing transboundary pollution. The ASEAN Agreement on Transboundary Haze Pollution (AATHP) aims to enhance cooperation in implementing measures to prevent, monitor, assess and mitigate incidents of forest fires and open burning. It facilitates the linkage and exchange of information and broaden the opportunities for mutual support in cases of transboundary haze pollution crises. The Thailand ASEAN Environmental Action Plan of Thailand 2018-2025 (revised edition 2019) thoroughly addresses the management of pollution and urban environments. The plan is structured around key strategic areas including Strategy 1 on conservation of nature and biodiversity, Strategy 2 on marine and coastal environments, Strategy 3 on water resource management, Strategy 4 on sustainable urban environments, and Strategy 6 on chemicals and waste. Additionally, ASEAN region has established task forces to address issues related to urban environmental management and pollution that impacts the environment, such as the ASEAN Working Group on Chemicals and Waste (AWGCW). This working group aims to enhance cooperation among ASEAN members in tackling global environmental problems and to broaden the scope of waste management to include all types of waste, including electronic waste. Furthermore, the ASEAN Working Group on Environmentally Sustainable Cities (AWGESCC) has been set up to define ASEAN indicators for environmentally sustainable urban environments, categorized into 3 main areas: air quality indicators (clean air), water quality indicators (clean water) and indicators for waste management and green spaces (clean and green land). Other working groups are the ASEAN Working Group on Coastal and Marine Environment (AWGCME) along with related cooperative efforts such as knowledge exchange on pollution management and contaminated soil and groundwater management. These initiatives are part of the broader Working Group on the Remediation of Soil and Groundwater Pollution in the Asia and Pacific Region (WG ReSAGPAPR).

Thailand has integrated strategic issues for sustainable urban development and mitigating its impacts on society and the environment into its planning across 3 levels. The Level 1 plan is National Strategy 2018-2037, under Strategic Direction 5, with a focus on creating growth that

is based on an environmentally friendly quality of life, on Issue 4 regarding developing urban, rural, agricultural and eco-industrial areas with continuous urban growth. The Level 2 plan, under National Strategy (2018-2037)'s Issue (18), addresses sustainable growth and includes a sub-plan for managing pollution and agricultural chemicals affecting the environment to meet international standards. This also links to other issues including Issue (6) on desirable smart spaces and cities with sub-plans for developing desirable smart cities and sustainably managing urban, rural, agricultural and eco-industrial areas according to sustainable ecological plans; Issue (19) on the comprehensive management of water systems with a sub-plan aimed at developing watershed management to enhance the country's water security; and Issue (23) on research and innovation development with a sub-plan for research and environmental innovation development. Additionally, the 13th National Economic and Social Development Plan (2023-2027)'s Milestone 8 focuses on Thailand having desirable, safe and sustainable smart cities and spaces and Milestone 10 emphasizes Thailand achieving a circular economy and a low-carbon society. The National Security Policy (2019-2022), under the 11th policy, emphasizes securing the stability of natural resource base and the environment. The Level 3 plan involves the strategy to propel Thailand forward with the BCG Economy model 2021-2026 and the National Enhancement and Conservation of Environmental Quality Policy and Planning 2017- 2037 under the 2nd policy, which aims to foster environmentally friendly growth for prosperity and sustainability. Moreover, relevant organizations have been revising and developing laws and regulations, reviewing action plans and standards related to environmental quality, such as the formulation of the 20-Year Pollution Management Strategy and the Pollution Management Plan 2017-2021. These efforts provide a framework and direction for the country's pollution management that aligns with national development goals and the evolving national and global contexts. They also serve as a guideline to promote the involvement of all sectors in national development concerning pollution management with shared goals and a unified direction. Developing standards for controlling industrial wastewater discharge for specific industries and advancing water quality forecasting and crisis warning systems are crucial for timely decision-making and mitigation of water quality issues. Furthermore, the development of tools for assessing the overall situation of marine water quality, or the Marine Water Quality Index (MWQI), will facilitate an understanding of water quality conditions. This also includes efforts in managing marine pollution through plans from relevant agencies, such as the National Oil Spill Pollution Prevention and Elimination Plan. The creation of the National Solid Waste Management Master Plan (2016-2021) and the draft of the National Waste Management Action Plan (2022-2027) serve as frameworks and guidelines for addressing pollution from waste that impacts the environment, public discomfort and health. The Phase 1 of the Plastic Waste Management Action Plan (2020-2022), as part of the Plastic Waste Management Roadmap (2018-2030), is designed to guide efforts in preventing and solving plastic waste issues impacting the environment. It aims for 100% recycling or reuse of plastic waste by 2027. There is also the draft of the Integrated Action Plan for the Management of Waste from Electrical and Electronic Equipment (2022-2026). Alongside,

efforts are being made to draft the Electrical and Electronic Equipment Waste Management Act, B.E....to ensure the efficient and academically sound management of electrical and electronic waste. Efforts to enhance the efficiency of community solid waste management include convening meetings of the Subcommittee on Plastic and Electronic Waste Management, along with the revision of legislation, planning and database systems by various agencies to ensure comprehensive operational coverage. For instance, Department of Health has updated the Ministerial Regulation on the Management of Toxic or Hazardous Waste from Communities 2020 and the Ministerial Regulation on the Disposal of Infectious Waste (No. 2) 2021. Regarding the issue of water quality management in Thailand, Office of National Water Resources has developed the 20-year National Water Resources Management Master Plan 2018-2037 to serve as a framework and guideline for addressing and improving the country's water resources, which have significant impacts on the population, and are crucial for economic and social support. This plan necessitates continuous actions and includes water-related projects under the climate change collaboration framework to ensure that operators at the watershed level possess the necessary knowledge and understanding to implement adaptive strategies within their specific watershed regions. The Institute of Water Resources Information (Public Organization) has developed the National Water Information Repository to serve as a central hub for collecting water resource data nationwide. This initiative aims to compile and provide information to support the management of water resources for relevant agencies.

The rise in urban population density has led to disorderly settlements and land utilization, precipitating a shortage of green spaces. Specifically, the availability of public green areas has not kept pace with the population increase, causing a decline in both the amount and quality of these spaces as well as the deterioration of natural landscapes and cultural landmarks. Green spaces are regarded as a key indicator of the well-being of urban populations. An ideal city should possess green spaces of high quality in adequate amounts that are easily accessible to its residents. Efforts to drive the development of green cities are supported through collaborations under the Indonesia - Malaysia - Thailand Growth Triangle (IMT-GT) and initiatives like the ASEAN award for sustainable urban environments. In 2021, Thailand nominated several municipalities to participate in the ASEAN Environmentally Sustainable Cities (ESC) Award. The municipalities that won the ASEAN ESC Awards 2021 include Hat Yai City Municipality in Songkhla, Thung Song Town Municipality in Nakhon Si Thammarat, Krabi Town Municipality in Krabi and Yala City Municipality in Yala. Additionally, the development of ASEAN criteria and indicators for sustainable urban environments has been a focus, with Thailand initiating sustainable ASEAN environmental model city activities in 6 exemplary communities or municipalities. These include Udon Thani City Municipality in Udon Thani, Phuket City Municipality in Phuket, Takhli Town Municipality in Nakhon Sawan, Wiang Thoeng Subdistrict Municipality in Chiang Rai, Chaman Subdistrict Municipality in Chanthaburi and Ban Sang Subdistrict Municipality in Phayao. These initiatives serve as learning models such as comprehensive waste management and recycling bank projects. Thailand faces challenges in managing natural and artistic environments, with key factors impacting changes in these areas including the influence of climate change or natural disasters that affect

the characteristics of natural and cultural sites, the provision and condition of ecosystems and disturbances caused by human activities. Thus, Thailand has developed the 20-Year National Strategy for the Conservation of Natural and Artistic Environments (2018-2037) and a 20-Year Master Plan for the Conservation of Natural and Artistic Environments (2018-2038) to prepare for adaptability to various changes and to proactively manage natural and artistic environments, enhancing the role of conservation in sustainable development.

1. Development Agenda: Due to rapid growth in economic, industrial and urban development, there has been a significant degradation and depletion of natural resources, leading to increased pollution. Thus, this has resulted in the concept of resource utilization with efficiency, reducing pollution at its origin and the management of solid waste as well as hazardous and infectious waste. It also involves ecological community environmental management, taking into account all fundamental dimensions, including economic, socio-cultural and environmental factors. Enhancing green spaces and managing the natural and artistic environments are aimed at achieving sustainable management of environmental conditions and pollution that affect the entire ecosystem. The details are as follows:

The quality of surface water sources and the quality of marine water sources: Water is an essential resource for the existence of life. It plays a pivotal role in national development and as a fundamental factor for economic growth. As urban expansion, economic activities and industrial and agricultural developments surge rapidly, the demand for water in all sectors increases, resulting in the degradation of water quality. This, in turn, leads to pollution problems that adversely affect water quality and its usability. When surface water sources become contaminated, it can lead to the pollution of nearby groundwater with the same toxins. This is particularly true in areas where community waste is buried, industrial waste disposal sites, industrial estates or factories, as well as mining areas and agricultural lands. These areas are at high risk of contamination from hazardous substances including heavy metals and toxic chemicals, organic compounds and volatile organic compounds. Such pollution has a direct impact on the environment and the public health. Currently, the overall quality of groundwater typically falls within the acceptable standards for drinking water. However, in some areas, the levels of iron, manganese, fluoride and chloride exceeded the standards for drinking water. This is due to geological and hydrogeological conditions. For the quality of surface water sources in 2021, the majority, 86%, were rated from fair to excellent and there were no water sources classified as highly deteriorated. When compared to 2020, the overall quality of water sources improved slightly and the proportion of deteriorated water sources decreased from 14% in 2020. Upon examining the quality of marine water sources in 2021, it was found that 3% of the sources were in excellent condition, 47% were good, 40% were fair, 7% were moderately deteriorated, and 3% were severely deteriorated. Despite the reduction in tourist numbers in coastal provinces due to the COVID-19 pandemic, the primary factors contributing to marine pollution continued to be wastewater discharge from community consumption and tourism, industrial processes and fishing vessels. This has led to phenomena such as discoloration of sea water and oil spills in the sea. Changes

in sea water temperature also affect the marine environment, such as coral bleaching. These environmental changes have a cascading effect on tourism, fisheries and coastal aquaculture. Thailand has implemented measures to mitigate the deterioration of water sources and improve national water quality. This includes the development of specific industrial wastewater discharge standards and a forecasting system for water quality and early warning for water quality crises. These measures support timely decision-making to address issues and are complemented by systems that assist in the strategic planning and management of water pollution at the regional level.

Air and noise pollution: At present, air and noise pollution are among the significant global challenges, not limited to industrial cities but also prevalent in major urban areas experiencing rapid economic and industrial expansion. This growth leads to a high demand for transportation systems, coupled with a large number of vehicles and congested traffic conditions. Additionally, other activities, such as construction, open burning in agricultural sectors and roadside noise, contribute to the pollution, exceeding what human sensory perception can comfortably handle. As a result, these areas continue to face persistent air and noise pollution issues. Therefore, given the existing pollution situation, different sectors have mobilized policies, plans, legislative frameworks and operational measures through the collaboration of all stakeholders aimed at achieving suitable environmental management. This collective effort seeks to minimize the impact on ecosystems, the environment and the public. In 2021, Thailand witnessed an improvement in its overall air quality compared to 2020, driven by the concerted efforts of relevant agencies under the national agenda and specific plans to address particulate matter pollution. This was further aided by the COVID-19 pandemic, which caused a significant decrease in travel and commuting, with the majority of people shifting to working from home. This change in behavior resulted in a reduction in car use and traffic congestion. Thailand has acknowledged the importance of addressing air and noise pollution and has taken steps to manage air quality issues. Efforts include executing the national agenda's action plan for solving particulate matter pollution, establishing air pollution resolution centers, setting standards and control measures for air pollution sources, setting vehicle emission standards, improving regulations on benzene vapor emissions from fuel storage facilities, addressing the issue of sugarcane burning, initiating the "Collect, Not Burn" project and participating in international meetings under ASEAN agreements on transboundary haze pollution. The implementation of these plans and multi-level collaboration resulted in a decrease in the levels of PM_{2.5} particles by 4% and PM₁₀ particles by 7% in 2021, compared to 2020. Furthermore, noise pollution, which creates disturbing sounds that can lead to nuisance and exceed the capacity of human hearing to tolerate, remains an issue to be addressed. The World Health Organization (WHO) considers noise pollution as one of the most dangerous environmental threats to health. It not only causes irritation and nuisance but can also have direct effects on human health, such as gradual hearing loss or conditions leading to hearing impairment. The sources of noise pollution can come from various origins, including traffic noises and industrial operations. In 2021, the overall average noise levels in Thailand were found to be between 45.0 - 84.5 decibels (dB(A)), marking a reduction in average noise levels from the previous year. This reduction in noise levels can be partly attributed to the COVID-19

pandemic situation, during which the government implemented various measures such as closing locations with a high risk of transmission, encouraging remote work (Work from Home) and regulating travel times and various activities. In response to the mentioned issues, Pollution Control Department has taken steps to reduce and manage noise pollution through policies, plans, and various activities. This involves revising noise standards for motorcycles, establishing noise standards for hybrid vehicles and promoting the development of a draft action plan for managing noise and vibration pollution.

Community solid waste, hazardous community waste and infectious solid waste:

The growth of population and rising consumption each year, along with urban expansion, have led to an increase in community solid waste, hazardous community waste and infectious solid waste. Furthermore, the shift towards online business models has altered consumer behaviors, resulting in a higher volume of hard-to-decompose packaging. As a result, the amount of community solid waste has surged. Without proper management, this situation can harm the environment and public health. In 2021, it was found that 9.28 million tons of solid waste were properly managed, accounting for 37% of the total volume of solid waste. This marks a 7.04% increase from the 8.67 million tons managed in 2020. Despite this progress, the majority of the population does not segregate waste, leading to the combined disposal of all waste types. Local administrations still practice mixed collection of solid waste, loading it into garbage trucks, which complicates the sorting and recycling processes later on. Meanwhile, the disposal systems for community hazardous waste, which often include toxic or dangerous waste from households, businesses, hotels, airports, gas stations, photo studios and dry cleaners, are not fully efficient. Such waste includes items such as batteries, flashlight batteries, light bulbs, chemical containers, spray cans and remnants of electronic and electrical product appliances. Currently, only 22% of the hazardous waste is properly managed. The recent trend of increasing hazardous waste can be attributed to rapid technological advancements, which have altered consumer behavior, leading to greater demand for electrical appliances and electronic devices. This shift has resulted in more frequent updates to newer technologies, along with the importation of some products of lower quality with shorter usage life. Consequently, this has led to contamination and the spread of hazardous substances into the environment, entering food chains and impacting public health. It also results in the accumulation of waste and the contamination of soil and groundwater sources, particularly from the industrial and agricultural sectors, which utilize chemicals and pesticides. In 2021, Thailand imported a total of 3.22 million tons of hazardous substances from the industrial sector, an increase of 5.23% from 2020. However, when looking at the long-term trend over the past decade, there has been a decline in the importation of hazardous substances for industrial use in Thailand. In contrast, the import of hazardous agricultural chemicals in 2021 rose by 34.69% from 2020. The top three hazardous agricultural chemicals imported are herbicides, insecticides, and fungicides. As for infectious waste, it has been properly managed up to 90.85%. However, the outbreak of COVID-19 pandemic has resulted in a significant increase in the sources of infectious waste, exceeding the country's capacity to dispose of such waste. Department of Health, in collaboration with Department of Industrial Works,

Department of Local Administration, the Energy Regulatory Commission and related agencies, has integrated cooperation to address the mentioned problems by issuing regulations and directives to allow waste disposal factories that utilize incineration processes, power plants that generate electricity from municipal solid waste and cement production plants to temporarily use infectious waste as fuel in their furnaces. Additionally, the COVID-19 pandemic has changed the lifestyle of the population, resulting in not only an increase in the amount of community solid waste, hazardous community waste and infectious waste but also a continuous rise in plastic waste. In 2021, approximately 2.76 million tons of single-use plastic waste were generated. Most of this plastic waste is disposed of by landfilling and a portion is incinerated. This disposal method requires more land than other types of waste and takes a long time to decompose. This results in the wasteful expenditure of disposal budgets and landfill space, proving ineffective for recycling and causing problems in waste disposal. Ministry of Natural Resources and Environment has collaborated with related agencies across the government, private and academic sectors to promote the initiative of not using plastic bags, under the campaign "Every Day Say No to Plastic Bags," starting from 1 January, 2020. Efforts include setting measures for managing plastic waste from food delivery services, encouraging the reduction and discontinuation of single-use plastics in food delivery and replacing them with eco-friendly products. It also involves the procurement of environmentally friendly goods, setting voluntary standards for biodegradable plastic products and implementing the Circular Economy standards within organizations. The Zero Waste Community project, the Clean Province project, the development and promotion of standards for managing infectious waste and the manifest system for infectious waste transportation as well as the "Thais Without E-Waste" project, aimed at collecting e-waste and ensuring its proper management, are all part of these comprehensive efforts.

Community environmental management, green spaces and natural and cultural environments: Urban expansion has led to disorganized settlement and land use, negatively affecting the urban environment. Moreover, environmental management and urban planning fail to regulate land use in a way that balances physical, economic, social and environmental aspects. This impacts the ecosystems and urban environments as well as the lifestyles and properties of urban populations. Issue (6) of Master Plan under National Strategy focuses on creating desirable smart cities and regions. It mandates the development of an "ecological spatial plan" that utilizes environmental and ecosystem (ecoregion) principles that reflect the lifestyle of the local population. This serves as a tool to oversee and balance land use and manage community environments in a natural and ecological way. Office of Natural Resources and Environmental Policy and Planning has developed regional ecological spatial plans and provincial plans for appropriate ecological land use, starting with the northern region (9 provinces) as the initial area of focus. Additionally, it has prepared ecological spatial plans for different types of natural areas in the lower northern region. These efforts are designed to facilitate and promote effective management of natural areas based on their ecoregional potential, with the ultimate goal of balancing conservation and development. Office of Natural Resources and Environmental Policy

and Planning has developed guidelines and models for urban and community development based on the Eco-City concept. This initiative aims to serve as a prototype for urban development grounded in the principles of ecoregion. During 2018-2020, pilot projects were carried out in 3 municipalities: (1) Nam Chiao Eco-City in Trat Province, (2) Nakhon Sawan Eco-City in Nakhon Sawan Province and (3) Mai City Eco-Community in Lampang Province. In 2020, Office of the National Economic and Social Development Council implemented a project to develop future cities for sustainable living. This initiative aligned with urban development based on ecoregional principles in 2 municipalities which were Nakhon Lampang Municipality and Sukhothai Municipality. Furthermore, the Association of Municipalities of Thailand has undertaken an ecological spatial planning project, aimed at transforming cities into more desirable and sustainable places to live. This initiative involves providing training on how to create ecological spatial plans to 38 pilot municipalities. The aim is to encourage municipalities to develop ecological spatial plans that will drive the evolution of cities developed on an ecoregional basis. From 2021 to 2022, a project was carried out with a focus on the sustainable management of ecoregional environments and natural and artistic environments. This effort led to the mapping of the conservation areas of cultural sites by category in the northern region. The objective was to establish spatial plans for conserving environmental areas of cultural significance, such as historical community districts, based on ecoregional principles across the 17 provinces of the northern region. In addition, in 2021, operations were conducted to create mapping and management plans for Thara Rak Waterfall area in Mae Sot District, Tak Province, as the first pilot area for establishing ecological spatial plans for natural environments. This initiative is set to be expanded to at least 5 other types of natural sites during 2023 - 2027 to support and promote the management of natural areas in line with ecoregional capacities, thereby achieving a balance between conservation and development. Under the goals set for 2022, Thailand has an ecological spatial planning framework in place aimed at developing desirable cities, stable rural areas, sustainable agriculture and eco-friendly industries. This includes maps for conservation areas, natural resources and archaeological sites in 1 region. The ambition is to extend these frameworks across all 6 regions of the country by 2037.

Green spaces refer to natural areas or areas designated by humans within cities or communities, primarily composed of plants. These spaces are beneficial for the environment, ecological systems and the people's quality of life. World Health Organization (WHO) has established a guideline that urban areas should provide at least 9 square meters of green space for each person. This standard aims to ensure that residents have access to green areas and can benefit from various aspects these spaces offer. Office of Natural Resources and Environmental Policy and Planning has formulated guidelines for the sustainable management of green spaces. The goal is to provide citizens with access to public service green spaces of at least 15 square meters per person by 2037. Furthermore, it identifies 6 categories of green spaces, defined by their features and functions: (1) Public green spaces, (2) Utility green spaces, (3) Linear green spaces along public utilities, (4) Community economic green spaces, (5) Natural green spaces and (6) Unused green spaces. According to the Environmental Quality Situation Report 2022 by Office of Natural Resources and Environmental Policy and Planning, the ratio of public green space per capita in Pattaya City was found to be 4.27

square meters per person. For city municipalities and town municipalities, the average ratios of public green space per capita are 5.08 square meters per person and 4.31 square meters per person, respectively. Sub-district municipalities, on average, offer 8.59* square meters of public green space per person (*This figure is derived from 650 out of 2,247 sub-district municipalities), indicating that the green space ratio in urban areas per capita still falls below the standard set by WHO. In this regard, Office of Natural Resources and Environmental Policy and Planning has developed guidelines for the sustainable management of green spaces (a 20-year long-term plan) and operational approaches to promote the sustainable management of green areas. Currently, the work on the second phase of the operational guidelines (2023 - 2027) is underway, following the conclusion of the first phase in 2022. This is aimed at implementing the goals and indicators of the sustainable management guidelines. In 2021, Department of Environmental Quality Promotion carried out assessments of cities for sustainable environmental management at both local and national levels. This assessment framework utilized 4 main components and 34 indicators. To align with these sustainability goals, Bangkok embarked on the Green Bangkok 2030 project, aiming to increase green spaces to 10 square meters per person and enhance public green spaces accessible within a 400-meter distance. It also aims to expand the city's tree cover. Significant actions taken during 2021-2022 include the development of the On Nut Eco Forest Project's first phase over an 18-rai area, focusing on mimicking natural forest growth to expand urban forest coverage.

Natural environments are valued for their scientific significance and beauty, representing key geological and geographical features that characterize or symbolize a particular locale. These natural sites can be broadly categorized into 2 types: dynamic and static. Dynamic natural environments are capable of changing, moving and naturally restoring themselves, such as forests, meadows and wildlife. On the other hand, static natural environments lack the capacity to change, move or restore themselves once destroyed, leading to irreversible loss, such as mountains, caves, waterfalls, islands, rapids, sandy beaches, rocky shores, lakes, ponds, water bodies, fossil sites and geological formations. Office of Natural Resources and Environmental Policy and Planning has undertaken actions to protect natural sites identified for preservation to ensure their sustainability. This includes conducting regular assessments and monitoring the environmental quality and ecological health of 4 types of natural conservation areas which are waterfalls, mountains, geological formations and caves. The goal is to ensure these important natural sites are regularly monitored and evaluated and to understand the environmental quality in their surrounding areas. This approach aims to preserve these surrounding areas from degradation and minimize any adverse impacts, thus conserving their natural value over time. The findings from the evaluation based on environmental quality preservation criteria indicate that, for the most part, the conservation efforts are maintaining the environmental quality at a good level.

Artistic environments are human-created or defined spaces, including the surrounding areas that form part of and are interconnected, both directly and indirectly, with artistic sites. These sites are recognized for their artistic, cultural, historical, archaeological and technological significance. Artistic environments can be categorized into 2 types: active art forms, such as

temples, government buildings, commercial and residential buildings and cultural districts; and inactive art forms (no longer serving their original function), such as archaeological ruins, abandoned temples, city walls, ancient moats, historical and archaeological sites. If artistic environments are damaged or deteriorate, or if the significance of art sites is overlooked due to a lack of public awareness and understanding of their importance, benefits and value, it can lead to unintentional destruction, both directly and indirectly. This lack of recognition can cause the art sites to lose their value and eventually become meaningless over time. In the fiscal year 2021, Office of Natural Resources and Environmental Policy and Planning, acting as the secretariat for the Committee for the Conservation and Development of Rattanakosin and Old Towns, initiated actions to designate additional old town areas in 3 cities (namely, Old Town Uthai Thani, Old Town Trang and Old Town Chachoengsao). This effort led to the official declaration by the Cabinet of a total of 36 old towns as conservation areas, in accordance with the Regulation of the Prime Minister's Office on the Conservation and Development of Rattanakosin and Old Towns 2021. Additionally, support is provided to provinces that house old towns to develop action plans for conservation and development of these areas. These plans serve as primary frameworks for managing old towns and guide the formulation of specific urban plans by Department of Public Works and Town & Country Planning. The aim is to preserve the unique identity and historical context of old towns, ensuring they retain their value for tourism, economic and social benefits to the community and the country. The project to drive the operation of conservation and restoration of 50 old community districts at the provincial level, Phase 1 in 2020 and Phase 2 in 2021, involved surveying old community districts to supplement the database with a complete list of names and locations, thereby ensuring a more comprehensive coverage of all districts in each province. The project also undertakes the registration of historical and archaeological sites, aiming to protect and preserve the cultural heritage in the form of historical and archaeological sites. At present, Thailand has 7,794 historical and archaeological sites listed by the Fine Arts Department. Of these, 2,067 sites have been officially registered in the Royal Gazette in 2020 and 23 more historical sites were registered during 2021 to 2022. Additionally, the project has undertaken the conservation and development of 11 historical parks, including (1) Phra Nakhon Khiri Historical Park in Phetchaburi Province, (2) Mueang Sing Historical Park in Kanchanaburi Province, (3) Ayutthaya Historical Park, (4) Si Thep Historical Park in Phetchabun Province, (5) Sukhothai Historical Park, (6) Si Satchanalai Historical Park in Sukhothai Province, (7) Kamphaeng Phet Historical Park, (8) Phu Phrabat Historical Park in Udon Thani Province, (9) Phimai Historical Park in Nakhon Ratchasima Province, (10) Phanom Rung Historical Park in Buri Ram Province and (11) Sadokkokthom Historical Park in Sa Kaeo Province. These sites have undergone preservation, conservation and development to serve as educational and tourist destinations effectively and sustainably. In the fiscal year 2021, 2 pollution-free waste incinerators were constructed within historical park areas, specifically at the Si Satchanalai and Kamphaeng Phet Historical Parks. These installations aim to address pollution issues arising from foam waste disposal, which directly impacts the natural environment. There has also been a campaign to

reduce, eliminate and eventually discontinue the use of foam containers and packaging at educational and tourist sites under supervision.

2. Details of Strategies: Urban environmental management and pollution mitigation strategies that impact the entire ecosystem focus on preventing, reducing and regulating pollution across various fronts, including water, air, noise, solid waste, infectious waste, hazardous waste, industrial by-products and agricultural chemicals. These strategies begin at the source, enhancing efficiency through the development of technology and innovation. Additionally, efforts are made to revise the country's environmental standards to align with international norms and strictly enforce these standards across all sectors. Tools and diverse mechanisms are developed for comprehensive pollution management, promoting integration across all sectors at the national level and encouraging both domestic and international cooperation in systematic pollution management. This Strategy encompasses 3 sub-strategies as follows:

Sub-strategy 4.1 Enhancing the efficiency of preventing, reducing and eliminating pollution: Enhancing the efficiency in the prevention, reduction, regulation and elimination of pollution in water, air, solid waste, infectious solid waste, hazardous waste and agricultural chemicals starting from the sources of pollution. It includes the development of relevant technologies and innovations to improve the effectiveness of pollution management strategies. This sub-strategy emphasizes 2 main aspects: 1) preventing and reducing pollution at its source and 2) controlling and eliminating pollution from both identified and unidentified origins. Key activities include promoting the reduction of waste, wastewater and hazardous chemicals at its source; accurately regulating and monitoring pollution sources for effectiveness; managing and eliminating pollution in water, air and soil; improving the management of solid waste, infectious waste, product remnants, electrical and electronic appliances and waste generated from construction and demolition activities; improving water, air, noise, solid waste and hazardous waste management; preventing and reducing all types of marine pollution, especially from land-based activities including marine debris; decreasing and ceasing the use of chemical pesticides and herbicides; and developing reports for assessment and analysis related to environmental impacts. Supporting activities include the adoption of economic tools and mechanisms to prevent, reduce, control, and eliminate pollution; the implementation of clear management measures and mechanisms; fostering the development and use of technology and innovation in preventing, reducing, regulating and eliminating pollution; promoting private sector investment, both directly and indirectly, in pollution management such as through tax incentive measures; raising public awareness of the value of marine resources and encourage public cooperation in preventing and addressing marine environmental issues; and integrating pollution prevention measures into the operations of relevant organizations.

Sub-strategy 4.2 Managing community environments and natural and cultural environments: This sub-strategy promotes the integration of all sectors at the national level as well as encourages domestic and international cooperation in environmental management. It emphasizes 2 main points: 1) management of community environments and 2) management of natural and

artistic environments. Key activities include establishing standards for the quality of natural and cultural environments; creating and enforcing urban planning as well as designating and layout mapping of natural and cultural environments; promoting urban designs based on principles of sustainable urban environments; promoting and developing green spaces with broader and more diverse perspectives for public relaxation and preventing encroachments on public areas; and overseeing the preservation of locations recognized as national and world cultural heritage sites. Supporting activities include establishing rules, standards, laws, tools and other mechanisms for managing urban environments and green spaces and protecting natural and cultural environments by executing a range of projects. For instance, compiling a registry of valuable buildings to guide the formulation of environmental and urban planning policies and practices aimed at managing and utilizing benefits derived from conservation efforts. Other projects involve cultural design and specific urban planning actions to support the utilization from the conservation of these buildings; developing and refining policies, plans and measures related to the management of community environments; and enhancing the capability and efficiency as well as supporting the roles of various sectors in managing community environments, natural and cultural environments.

Sub-strategy 4.3 Strengthening the mechanisms for pollution control: This sub-strategy involves developing and reviewing national environmental standards to align with international standards, considering their suitability for the country's specific context while strictly enforcing them across all sectors. It also includes developing and promoting diverse mechanisms to manage pollution comprehensively. This sub-strategy also emphasizes advocating for related regulations with a focus on 2 main points: 1) improving the monitoring, supervision and regulatory system and 2) enhancing public participation in pollution control. This encompasses efforts to develop related databases and accelerate the search for ways to enhance mechanisms and systems for tracking and inspecting pollution sources. Key activities include vigilant monitoring and observation of all forms of pollutant emissions, along with consistent monitoring of pollution situations; enhancing the accountability of manufacturers for the management of pollution and production waste; boosting the capabilities of local administrations in pollution control; and the development and integration of databases pertinent to pollution management efforts. Supportive activities include accelerating the development of mechanisms and systems for tracking and monitoring pollution sources; revising and amending laws and standards to reflect current situations; promoting research and development that strengthen pollution control mechanisms; endorsing the development and application of technology and innovation in pollution management; promoting involvement from all sectors; improving natural resource and environmental justice processes; developing international cooperation mechanisms to prevent, reduce and control transboundary pollution; and enhancing awareness, understanding, and consciousness about pollution among different sectors.

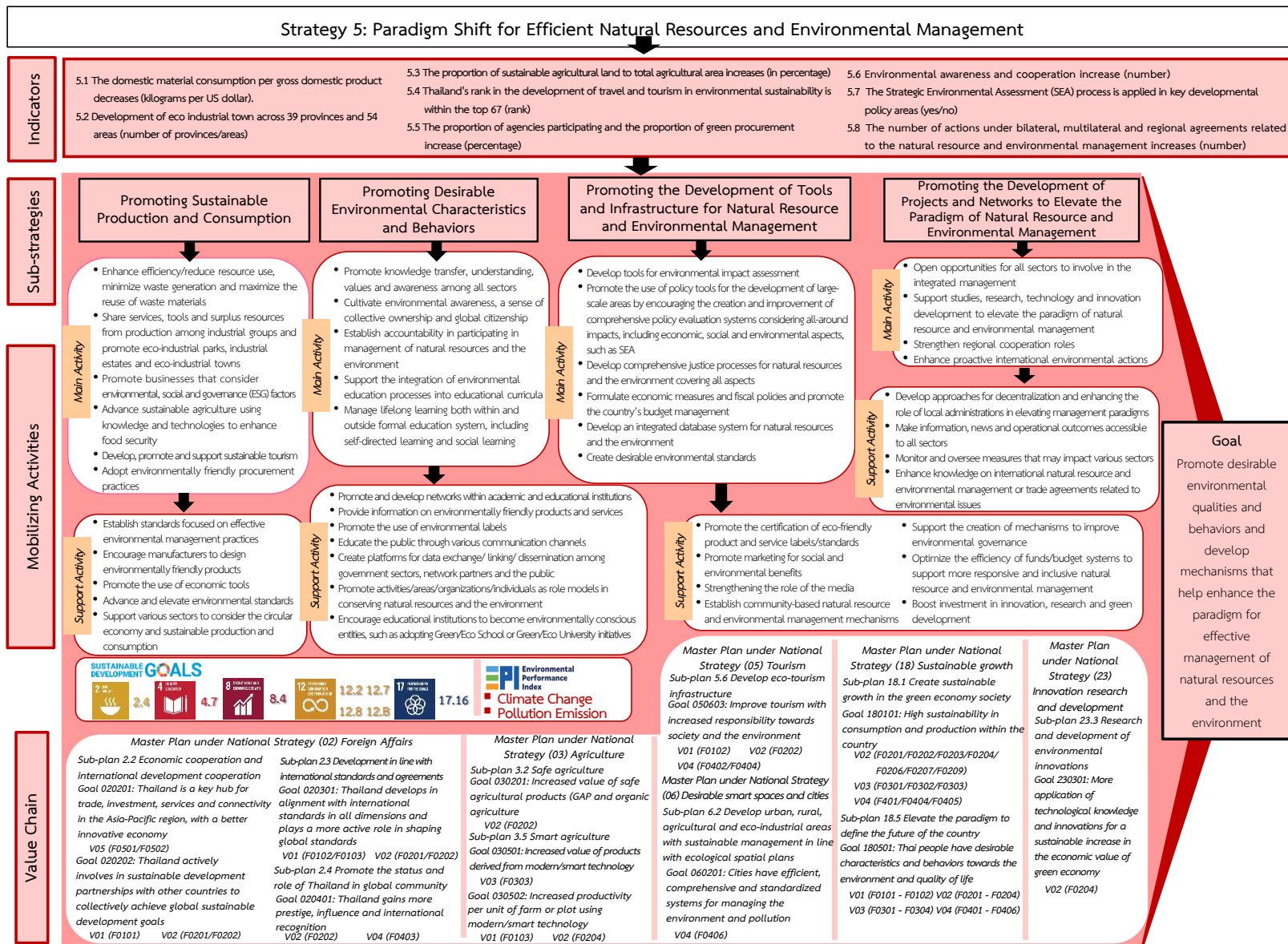


Figure 6: Strategy 5 Paradigm shift for efficient natural resources and environmental management

Strategy 5: Paradigm shift for efficient natural resources and environmental management

Goal: Promote desirable environmental qualities and behaviors and develop mechanisms that help enhance the paradigm for effective management of natural resources and the environment.

- Indicators:**
- 5.1 The domestic material consumption per gross domestic product decreases (kilograms per US dollar).
 - 5.2 Development of eco industrial town across 39 provinces and 54 areas (number of provinces/areas).
 - 5.3 The proportion of sustainable agricultural land to total agricultural area increases (in percentage).
 - 5.4 Thailand's rank in the development of travel and tourism in environmental sustainability is within the top 67 (rank).
 - 5.5 The proportion of agencies participating and the proportion of green procurement increase (percentage).
 - 5.6 Environmental awareness and cooperation increase (number).
 - 5.7 The Strategic Environmental Assessment (SEA) process is applied in key developmental policy areas (yes/no).
 - 5.8 The number of actions under bilateral, multilateral and regional agreements related to the natural resource and environmental management increases (number).

Economic growth relies on natural resources for both production and consumption. Given the limited availability of global resources, unsustainable practices in production and consumption have a significantly detrimental effect on both natural resources and the environment. Past development efforts have been imbalanced with inefficient use of natural resources. The demand for natural resources has exceeded the ecosystem's capacity to sustain it, coupled with significant pollution accumulation from production and consumption processes. This leads to impacts on human health and the degradation of natural resources and the environment. Examples include the industrial sector, which prioritizes profit without regard to environmental consequences, and the agricultural sector, which aims to produce enough food to satisfy global needs, thereby depending on chemical use in farming. Additionally, the service and tourism sectors overemphasize the growth of tourism or engage in mass tourism, resulting in the degradation of tourist spots and the depletion of the ecological advantages offered by these locations. Moreover, the growth of the fast fashion industry, characterized by low production costs and high demand, adversely affects the environment throughout the production and consumption process. This situation is compounded by rapid and diverse changes globally, such as in technology, innovation and management, potentially leading to new environmental and natural resource challenges. Globalization has intensified the connections among the economy, society and environment at national, regional and global levels, enabling the widespread transfer of goods, services, capital, labor, culture, etc., which has led to persistent transboundary issues. Addressing these issues requires cooperation from multiple countries, along with the development of systems, mechanisms and tools that

align with the unique contexts of areas and the various trends of change. This should go hand in hand with raising public awareness about participation and modifying behaviors to be more environmentally friendly.

The international community widely acknowledges that human activities are largely responsible for the decline and deterioration of natural resources and the environment. Achieving conservation and the efficient use of resources in a balanced and sustainable manner requires a collective shift in behavior across all sectors toward practices that support sustainable production and consumption. Raising public awareness about the importance of recognizing the finite nature of natural resources and adopting sustainable practices in production and consumption has become a critical mission in many countries around the world. At the 70th United Nations General Assembly in 2015, 193 member countries worldwide, including Thailand, endorsed the post-2015 Sustainable Development Goals (SDGs). The United Nations declared 17 SDGs as a global development agenda for the next 15 years (2016-2030), aimed at collectively addressing a range of pressing global public issues. These discussions emphasized SDG 12, which aims to ensure sustainable consumption and production patterns. This goal stresses the importance of shifting towards sustainable production and consumption, promoting the efficient use of natural resources, transforming company/organization production and service models, encouraging sustainable procurement among all sectors and fostering public awareness and behaviors that align with nature's capacity and the principles of sustainable development. Achieving this requires a collaborative approach among government agencies, the private sector and civil society, from policy formulation to tangible implementation at the grassroots level. Key principles underlying Sustainable Development Goal 12 include the circular economy, which aims for resources in the production cycle to be restored to their original state and reused, effectively tackling the future challenge of resource shortages and the Environmental Social Governance (ESG) principles which focus on sustainable organizational development aligned with the global shift towards a green economy.

Despite its rich natural resources, the ASEAN region is currently facing challenges in balancing economic development with natural resource conservation and environmental protection. Several factors contribute to environmental issues in the region, including population growth, economic expansion, and rapid industrial expansion. Recognizing the importance of these issues, member countries have integrated them into significant regional frameworks and agreements. These include the ASEAN Community Vision 2025 and the Kuala Lumpur Declaration on ASEAN 2025: Forging Ahead Together. These documents feature 3 related plans aimed at enhancing the paradigms for the management of natural resources and the environment as follows: the ASEAN Socio-Cultural Community (ASCC) focusing on sustainable production and consumption, environmental education, raising awareness and promoting environmentally friendly lifestyles at all levels; the ASEAN Political-Security Community on enhancing ASEAN cooperation in raising awareness; and the ASEAN Economic Community which addresses cooperation between the public and private sectors

(Public-Private Partnership: PPP). Other initiatives include the ASEAN Socio-Cultural Community (ASCC) Blueprint 2016-2025 focusing on sustainable production and consumption; the Framework for Circular Economy for the ASEAN Economic Community; the ASEAN Environmental Education Action Plan for 2014-2018; and the South Asia Forum on Sustainable Consumption and Production.

In ASEAN region, several initiatives have been undertaken concerning environmental and sustainability issues. These include forming the ASEAN Working Group on Environmental Education (AWGEE), hosting the ASEAN+3 Leadership Programme on Sustainable Consumption and Production, which facilitates the exchange of developmental experiences among member countries on topics such as green procurement, green certifications, eco-labels, sustainability standards, sustainable products and supply chains.

Thailand is transitioning towards an environmentally friendly economic and social system. The Cabinet has resolved to drive the development of the Bio-Circular-Green Economy (BCG Model), or the economic model towards sustainable development, as a national agenda from 2021 onwards. It has integrated the BCG Model, sustainable production and consumption, enhancing the paradigm for natural resources and environmental management, developing tools and mechanisms, as well as promoting international cooperation, into its national policies and plans across 1st, 2nd and 3rd levels. For example, the 1st level plan is National Strategy focused on promoting growth that enhances an environmentally friendly quality of life. It emphasizes conservation, protection, restoration and rejuvenation of natural resources and the environment, utilizing resources in a balanced manner and elevating the paradigm to shape the country's future in terms of natural resources, the environment and culture, based on principles of participation and good governance. The 2nd level plans are Master Plan under National Strategy, Issue (18) on sustainable growth, aiming to sustainably improve Thailand's environmental quality. The 13th National Economic and Social Development Plan (2023-2027), which sets 5 main objectives: transitioning the production and service sectors towards an innovation-driven economy, developing people for the new world, moving towards a society of opportunity and justice, transitioning production and consumption towards sustainability and enhancing the country's ability to adapt to changes and risks in the new global context. The 2nd level plans also include the National Security Policy and Plan (2019-2022), under the 12th policy, focuses on enhancing energy and food security, emphasizing the expansion of sustainable agricultural areas. The 3rd level plans include the National Enhancement and Conservation of National Environmental Quality Policy and Planning 2017-2037, with a key focus on adopting the principles of the Sufficiency Economy Philosophy for balanced management of natural resources and the environment. It aims to foster a shift in perspective towards intense and serious environmental-friendly development and to build an economy and society based on efficient resource use with minimal environmental impact. The 3rd level plans also involve the Sustainable Consumption and Production Roadmap 2017-2037 which emphasizes integrated advancement through social and technological innovations. Also integral is the action plan for driving Thailand's development through the BCG Economy

Model 2021-2027, which prioritizes transforming the economic and social development model based on the country's strengths. It aims to enhance the value within the production and service chains through the application of modern technology and innovation while simultaneously conserving resource base and biodiversity to ensure a balanced ecosystem, thereby fostering sustainable economic growth.

1. Development Agenda: Given the prevailing situations and developmental directions, it becomes clear that promoting the concept of efficient resource utilization, improving the efficiency of different tools and mechanisms and fostering partnerships in natural resource and environmental management should be prioritized in the next 5 years. This focus is essential to steer towards desirable changes in qualities and behaviors and to elevate the paradigms for natural resource and environmental management, with details as follows:

Sustainable production and consumption: Sustainable production and consumption refers to holistic actions across all sectors to minimize negative environmental impacts from production and consumption processes, while simultaneously enhancing the quality of life for all individuals. Key sectors driving this movement include the manufacturing industry, agricultural and food sector, service and tourism industry, urban sector and local administrations, sustainable procurement practices and the sectors focused on building awareness and education, with further details for each sector provided as follows:

- The manufacturing industry: The manufacturing industry plays a vital role in generating revenue for the country. Over the last 2-3 years, this sector has experienced a slight contraction due to the impact of the COVID-19 pandemic. However, Thailand has been advancing its industrial sector towards more sustainable practices. The emphasis on sustainable business operations has been growing among investors and entrepreneurs. In 2020, about 20% of Thai registered companies voluntarily prepared sustainability reports and disclosed information related to environmental, social and good governance aspects. There has also been support for the development of green industries that employ efficient production and management processes and are responsible for society and the environment. From 2011 to 2020, a total of 40,799 factories/businesses received green industry certifications. Additionally, the goal has been set for more than 71,130 industrial plants across the country under the supervision of the Ministry of Industry to evolve into green industries by 2025. Efforts are also being made to promote eco-industrial parks, designed with appropriate layouts, utilities, facilities and services to support businesses committed to efficient resource and energy management. Initiatives to develop eco-industrial parks have been launched in targeted areas across 15 provinces and 18 locations.

- The agricultural and food sector: The practice of monoculture farming, which relies heavily on fertilizers and chemicals with a primary focus on increasing productivity and generating national income, has led to broad environmental impacts. These include soil degradation, soil erosion and the loss of ground cover vegetation. Regarding the agricultural sector in Thailand, the sector's contribution to the Gross Domestic Product (GDP) in 2021 stood at 8.53%. Moreover, during 2016-2021, the agricultural GDP experienced a growth rate of 1.48%.

Currently, sustainable agriculture has emerged as a popular alternative. The Office of the Permanent Secretary for Ministry of Agriculture and Cooperatives has researched methodologies for developing tools to measure and monitor the effectiveness and sustainability of agricultural areas. These tools encompass economic, environmental and social dimensions, tailored to Thailand's context and following the guidelines set by the Food and Agriculture Organization of the United Nations (FAO). In the area of food waste and loss, Department of Agriculture has established a baseline for measures to reduce losses throughout the value chain. Additionally, the Pollution Control Department has drafted the Thailand Food Waste Management Roadmap, aiming to decrease the amount of food waste.

- The service and tourism industry: The service and tourism sector, a rapidly growing industry, has faced challenges due to tourist numbers exceeding the carrying capacity of destinations. However, the COVID-19 pandemic has significantly impacted Thailand's tourism industry, with the sector's contribution to the Gross Domestic Product (GDP) in 2020 decreasing by 63.92% from 2017. Thailand has applied the BCG Model to the service and tourism sector, aiming for sustainable tourism development that is mindful of its impacts on communities, ecosystems and biodiversity. This approach emphasizes transitioning to green and high-value tourism. Additionally, Ministry of Tourism and Sports has created the Tourism Satellite Account-System of Environmental-Economic Accounting (TSA-SEEA), which incorporates environmental costs to reflect the tourism sector's impact on natural resources and the environment.

- The urban sector and local administrations: The density of urban areas and population growth lead to increased consumption, necessitating the concept of sustainable city management. This includes developing environmentally friendly construction systems, from the design phase and selecting eco-friendly materials to waste management and optimizing public utility systems for resource efficiency. Department of Health encourages all levels of local administrations to enforce laws under the Public Health Act, B.E. 2535 (1992), implementing regulations for waste and refuse management.

- The sustainable procurement practices: The procurement of goods and services that create benefits for organizations, society and the nation by reducing the environmental impact from the production process. Pollution Control Department has promoted the selection of environmentally friendly products and services alongside other criteria, such as the assessment standards for green offices and eco-friendly hotels set by Department of Environmental Quality Promotion. This initiative aims to create tangible progress and encourage collaboration among different agencies to engage in the procurement of environmentally friendly goods and services. In 2021, the sectors participating in the procurement of environmentally friendly goods and services included government agencies, public organizations, state enterprises, higher education institutions and state-supervised agencies, accounting for 75% of the total. Local administrations made up 12%. Regarding the value of procuring environmentally friendly goods and services, government agencies, public organizations, state enterprises, higher education institutions and state-supervised agencies accounted for 38% of the total value, while local administrations accounted for 10%. In 2021, the database of eco-friendly goods and services listed a total of 39 categories and 1,385 items. These were divided into categories such as Green Label, Green Basket, eco-friendly hotels, Cool Mode fabric

products and the Global Warming Reduction Label. Additionally, Ministry of Finance has issued the Ministerial Regulation Listing Supplies and Methods for Procurement of Supplies that the State Wishes to Promote or Support (No. 2), B.E. 2563 (2020). This regulation mandates that eco-friendly goods listed by Pollution Control Department be recognized as supplies that the government aims to endorse or support. The execution of this initiative remains on a voluntary basis.

- The sectors focused on building awareness and education: Awareness and education play a crucial role in the significant challenges of modifying lifestyles and behaviors to be more environmentally friendly. This shift requires altering perceptions, enhancing awareness and developing individual and societal understanding, serving as the foundation of behavioral change. Achieving these changes demands collaborative efforts across different sectors, combined with the improvement of fundamental public infrastructures to support eco-friendly living practices. Specifically, embedding environmental issues within the educational system is critical because instilling environmental values in children and youths is key to cultivating future citizens with desirable environmental behaviors and characteristics. Ministry of Education has integrated global citizenship and education for sustainable development into its curriculum, focusing on enhancing awareness of natural resources and environmental conservation. In support of this, the promotion of the Volunteer Network for Natural Resources and Environmental Protection (VRN) has been emphasized. In 2021, the network saw an increase to 258,910 members, a growth of 10.6% compared to 2020. Similarly, the number of private environmental organizations also rose, with 290 entities recorded in 2021, a 1.4% increase from 2020.

Tools and mechanisms for managing natural resources and the environment:

Elevating the paradigms for natural resource and environmental management emphasizes improving the efficiency of tools and mechanisms including legal tools, economic tools, environmental justice processes, database systems, as well as environmental impact assessments. In recent years, Thailand has enacted appropriate and modern laws related to natural resources and environmental protection. Examples include regulations from Department of Marine and Coastal Resources on the cultivation and maintenance of mangrove forests for external organizations or individuals issued in 2021, regulations from Department of Forestry on sharing carbon credits from planting, maintaining, conserving and restoring forests within forest areas issued in 2021 and regulations from Department of National Parks, Wildlife and Plant Conservation on sharing carbon credits obtained from planting, maintaining, conserving and restoring forests in conservation areas. These measures aim to encourage external organizations or individuals to participate in planting, maintaining, conserving and restoring forests to maintain ecological balance. Additionally, efforts are being made to expand green spaces to achieve a target of 55% of the country's area in accordance with National Strategy, as well as to facilitate the distribution and sharing of carbon credits. Furthermore, there are ongoing efforts to develop legislation that facilitates efficient management of natural resources and the environment. Examples include the (draft) Electronic and Electrical

Equipment Waste Management Act, B.E..., the (draft) Climate Change Act, B.E.... and the (draft) Biodiversity Act, B.E....

Thailand has utilized economic tools to motivate and enhance the management efficiency of natural resources and the environment. Examples include offering tax incentives from the Board of Investment for eco-car manufacturers, setting different excise tax rates on fuel by Excise Department and implementation of a Feed-in Tariff by Ministry of Energy to encourage citizens to install rooftop solar power systems by guaranteeing a set rate for purchasing the electricity generated from renewable resources. As well, Department of National Parks, Wildlife and Plant Conservation also collects entrance fees to national parks, using these funds to support the conservation and restoration of natural resources at tourist sites. The Environmental Fund has also been established to aid and subsidize projects committed to enhancing and preserving environmental quality, targeting a broad range of stakeholders including government sectors, local administrations, private environmental organizations, community volunteer networks for natural resource and environmental protection, public organizations, educational institutions, village committees, sub-district community organizations and units dedicated to conserving natural and local cultural environments.

Creating a national database on natural resources and the environment involves platforms such as the Thailand Greenhouse Gas Emissions Inventory System (TGEIS), designed for the accurate, transparent and verifiable reporting of greenhouse gas emissions in compliance with international commitments and timelines. Another significant resource is the Thailand Biodiversity Information Facility (TH-BIF), a network that compiles and connects biodiversity data within Thailand, facilitating the sharing of information with related domestic and international agencies and sectors through real-time Application Programming Interfaces (APIs). These systems can serve as valuable academic reference databases. Furthermore, a range of applications have been introduced to aid in the management of natural resources and the environment. For instance, Pollution Control Department has created the Air4Thai application, which provides reports on Thailand's air quality index, including a map displaying data from pollution monitoring stations across the country, making air quality information accessible to the general public. Moreover, Office of Natural Resources and Environmental Policy and Planning has developed the SMART EIA application, a database system for environmental impact assessment reports. This system aims to simplify procedures, enhance efficiency, improve transparency and facilitate easier access to information.

The Strategic Environmental Assessment (SEA) is a systematic process that aids in the decision-making process for establishing policies, plans, or programs. It emphasizes the importance of participation and the balanced integration of economic, social and environmental aspects. Office of Natural Resources and Environmental Policy and Planning initiated a review and improvement of the environmental impact assessment system and recommended the adoption of the SEA process as a tool to enhance environmental management starting in 2003. This was aimed at integrating SEA into the early stages of policy,

plan and regional development *processes* that align with the area's capacity to manage and mitigate pollution. Subsequently, the National Economic and Social Development Council drafted and disseminated SEA guidelines (revised edition), enabling different agencies to apply SEA in developing certain management plans. Examples include plans for managing water resources in river basins and potash mineral resources as well as strategies for land and soil resource management. Currently, the National Economic and Social Development Council is in the process of creating the (draft) Regulation under the Prime Minister's Office on Strategic Environmental Assessment (SEA), B.E.... This regulation is intended to serve as a tool to encourage and support government agencies in incorporating environmental concerns into their plans and projects, alongside economic, social and other relevant factors.

Strengthening capabilities to address issues of international environmental cooperation: The concept of borderless connectivity, economic integration and the heightened sense of responsibility as global citizens underscore the need for collective responses to challenges such as climate change, transboundary pollution and the shared use of international resources. Such challenges lead to the development of stricter international laws, regulations and cooperation at both regional and global levels. Thailand has actively engaged in incorporating environmental clauses into its Free Trade Area (FTA) agreements and has played a significant role in international cooperation by forming agreements with various international organizations. Examples include a cooperative agreement between Ministry of Natural Resources and Environment and the Embassy of the Kingdom of the Netherlands in Thailand, supporting a partnership with The Ocean Cleanup for a pilot project aimed at managing river waste before it reaches the seas. Additionally, Thailand has entered into an operational agreement under the Paris Agreement with the Swiss Confederation, marking the world's first joint carbon credit transfer agreement. This opens opportunities for Thailand and Switzerland to collaborate under Section 6.2 of the Paris Agreement, establishing a voluntary framework for the cross-border transfer of greenhouse gas emission reductions. Through this partnership, Thailand will gain access to financial assistance, investment and environmental technology. Thailand has also forged a collaborative agreement with the Lao People's Democratic Republic on a project to establish the Thai-Lao 428 This initiative aims to create a conservation hub for the collection and preservation of valuable, rare and endangered plant genetics. It is intended to serve as a sustainable natural relaxation and tourism spot, as well as to foster collaboration among botanists for the study of plant species from both countries.

2. Details of Strategies: The Strategy to enhance the paradigms for effective natural resource and environmental management focuses on promoting the efficient and sustainable use of resources in both production and consumption sectors. It emphasizes fostering desirable environmental qualities and behaviors, prioritizing the development of knowledge, understanding, awareness, a sense of shared ownership and accountability in participating in the management of natural resources and the environment. This involves enhancing the development of systems, tools and mechanisms to make the management of natural resources and the environment more effective. Additionally, it includes advancing

the development of networks to improve the natural resource and environmental paradigm both domestically and strengthening international cooperation. This Strategy comprises 4 sub-strategies as follows:

Sub-strategy 5.1 Promoting sustainable production and consumption: Fostering management practices that create a society of sustainable production and consumption involves establishing systems that use resources efficiently and cost-effectively. Core activities include enhancing efficiency and reducing the use of natural resources; decreasing the amount of waste or by-products from production and consumption processes by promoting more efficient production and service processes across the industrial, agricultural and tourism sectors throughout the supply chain; supporting the use of appropriate technologies that maximize the reuse and recycling of waste; promoting the sharing of services, tools and excess resources among industrial groups; advocating for the adoption of eco-industrial principles in factories, industrial estates and industrial cities; promoting business practices that are mindful of environmental, social and governance (ESG) standards; advancing sustainable agriculture; supporting new generations of farmers to apply contemporary knowledge and technologies towards sustainable farming practices; enhancing household food security; developing, promoting and supporting sustainable tourism; and advocating for environmentally friendly procurement of goods and services. Supporting activities encompass establishing environmental management standards, encouraging manufacturers to design eco-friendly products; promoting economic tools to incentivize sustainable production and consumption across various sectors; advocating for the adoption and internationalization of environmental standards in organizational management or business operations; and urging stakeholders to consider circular economy principles as well as sustainable production and consumption practices.

Sub-strategy 5.2 Promoting desirable environmental characteristics and behaviors: This sub-strategy focuses on fostering an environment that promotes shifts in behavior towards eco-friendly practices across all sectors, aiming to accommodate green growth and adapt to various changes on both national and global scales. Key activities include promoting knowledge sharing, understanding, values and awareness across all sectors; fostering environmental consciousness, a sense of collective ownership and global citizenship; building a sense of accountability for participating in the management of natural resources and the environment; supporting the integration of environmental education into educational curricula; and facilitating lifelong learning both within and outside formal education systems and through self-directed and community-based learning. Supporting activities include fostering and developing networks within the academic and educational institutions; providing information on environmentally friendly products and services; motivating behavioral changes towards environmental friendliness; supporting the use of environmental labels; educating the public on conserving and efficiently utilizing natural resources through various communication channels; creating platforms for data exchange/linking/dissemination among government sectors, network partners and the public; promoting activities/ areas/ organizations/individuals

as conservation role models to inspire and broaden the impact; as well as encouraging educational institutions to become environmentally conscious entities, such as adopting Green/Eco School or Green/Eco University initiatives.

Sub-strategy 5.3 Promoting the development of tools and infrastructure for natural resource and environmental management: This sub-strategy emphasizes improving the efficiency of systems, tools and mechanisms across legal, economic and data infrastructure. Key activities include developing environmental impact assessment tools; advocating for the use of policy tools for large-scale area development through promoting the creation and improvement of an integrated policy evaluation system that considers comprehensive impacts, including economic, social and environmental aspects such as the Strategic Environmental Assessment (SEA); developing an all-encompassing natural resource and environmental justice system; formulating economic and fiscal measures and advancing the country's budget management; creating an integrated database system for natural resources and the environment; and establishing desirable environmental standards. Supporting activities include promoting the certification of eco-friendly product and service labels/standards; promoting marketing for social and environmental benefits; strengthening the role of the media; establishing community-based natural resource and environmental management mechanisms; supporting the creation of mechanisms to improve environmental governance; optimizing the efficiency of funds/budget systems to support more responsive and inclusive natural resource and environmental management; and boosting investment in innovation, research and green development.

Sub-strategy 5.4 Promoting the development of projects and networks to elevate the paradigm of natural resource and environmental management: This approach focuses on developing projects that facilitate decentralization and enhance local-level management, fostering partnerships in the management of natural resources and the environment and promoting international cooperation to support sustainable management of natural resources and the environment. Key activities include opening opportunities for all sectors to participate in the integrated management of natural resources and the environment; supporting studies, research, technology and innovation development to elevate the paradigm of natural resource and environmental management; strengthening regional cooperation roles to collectively address and solve transboundary natural resource and environmental issues; as well as enhancing proactive international environmental actions, such as improving the negotiation capabilities of officials and preparing for international policies/commitments, initiatives and leadership roles. Supporting activities involve developing approaches for decentralization and enhancing the role of local administrations in elevating management paradigms; making information, news and operational outcomes accessible to all sectors; monitoring and overseeing measures that may impact various sectors; and enhancing knowledge on international natural resource and environmental management or trade agreements related to environmental issues.



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