COMPONENT 2

INTEGRATION OF NATURAL CAPITAL ACCOUNTS INTO LOCAL DEVELOPMENT PLANNING AND OPERATIONS

THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN PUBLIC AND PRIVATE SECTOR POLICY AND DECISION-MAKING FOR SUSTAINABLE LANDSCAPES

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COMPONENT 2

INTEGRATION OF NATURAL CAPITAL ACCOUNTING INTO LOCAL DEVELOPMENT PLANNING AND OPERATIONS

OUTPUT 2.2.7

IDENTIFICATION AND PRIORITIZATION OF OPPORTUNITIES FOR PUBLIC-PRIVATE PARTNERSHIPS (PPPS) IN CONSERVATION, IMPACT MITIGATION, AND RESTORATION OF DEGRADED HABITATS IN HEADWATER FORESTS AND NEARSHORE MARINE AND COASTAL ECOSYSTEMS IN KRABI PROVINCE

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Executive Summary

Introduction

This report looks at how to include "Natural Capital" in Krabi Province's development plans. Krabi's economy depends mainly on tourism. Tourism, in turn, depends directly on the health of local ecosystems, such as forests, mangroves, and coral reefs. If nature is damaged, Krabi's economy will suffer.

The main aim of output 2.2.7 is to find ways for the government and private businesses to work together through Public-Private Partnerships (PPPs). Despite limits to government funding and staff, the environment needs urgent help. This report proposes teamwork models to fix pollution problems in busy tourist areas like Ao Nang and Koh Lanta.

Environmental Problems

Krabi's nature is under heavy pressure. Three major threats are putting Krabi's status as a world-class destination at risk:

- **Wastewater Crisis:** Ao Nang has grown too fast for its infrastructure. The current wastewater plant can treat about 1,200 cubic meters per day. However, in the high season, the amount of wastewater is estimated to be 3,000–4,500 cubic meters per day. This is far too much for the system. As a result, dirty water flows into canals and then straight into the sea. This hurts public health and Krabi's image.

- **Damage to Nature:** Even though many areas are protected, the sea and forests are still being damaged. Too many boats and buildings along canals are harming the ecosystem. Boat anchors are damaging coral reefs, and seagrass beds are being disturbed.

- **Too Much Trash:** Krabi produces over 495 tons of trash every day (2022 data). Cleanup programs are inadequate to collect and dispose of all this waste, especially on islands like Koh Phi Phi. More funding and a comprehensive disposal regime are needed.

Driving PPP Mechanisms for Sustainability in Krabi

There are many opportunities to support PPP mechanisms in Krabi by integrating cooperation between the government, private sector, and civil society to conserve ecosystems. Key strategic initiatives include "Krabi Goes Green" (transitioning to 100% renewable energy by 2026) and "Krabi Rewild" (a social movement featuring the "Waste is not Orphan" project to convert non-recyclable waste into Refuse-Derived Fuel (RDF), and the "Koh Lanta Declaration" (aiming for Net Zero/Blue & Green Island Tourism). These efforts rely on strong multi-sectoral collaboration to ensure sustainable natural resource management.

Meeting on Ao Nang Wastewater

Date: November 17, 2025
Location: Deevana Plaza Krabi Ao Nang Hotel
Participants: 34 persons

The multi-stakeholder meeting organized to address the wastewater crisis in Ao Nang was a critical milestone in this project. The meeting aimed to build consensus on collaborative solutions under a PPP framework.

Key Issues Identified

- **Infrastructure Deficit:** The current wastewater collection piping network does not cover the entire district. Many small businesses and street food vendors lack proper grease traps or treatment systems, discharging directly into public drains.

- **Regulatory Gaps:** There is a lack of enforcement targeting non-compliant businesses. Furthermore, small hotels often evade Environmental Impact Assessment (EIA) requirements, leading to substandard wastewater management.

- **Budgetary Constraints:** Local authorities (Ao Nang TAO) lack the personnel and technical knowledge to effectively monitor all establishments or invest in necessary infrastructure upgrades.

Stakeholder Roles Identified in the Meeting. It was agreed that:

- **Private Businesses:** They are willing to pay fees to treat wastewater. However, they want honesty. The system must actually work (clean the water), and the rules must apply to *everyone* (not just big hotels) so it is fair.

- **Community:** Local leaders want strict rules targeting businesses that use "fake" treatment systems just to pass inspections.

- **Government:** Agencies proposed the "Polluter Pays Principle." This means if you use water, you pay a fee. This money will invest in necessary infrastructure upgrades

Stakeholder Analysis The success of PPPs depends on understanding the dynamics of key players in the area:

1) Public Sector (The Facilitator): The public sector is shifting from a "Regulator" to a "Facilitator" role but faces structural barriers, including red tape and policy discontinuity due to administrative transfers, and budget constraints.

2) Private Sector (The Main Engine): The private sector shows high readiness and potential for environmental investment, recognizing that "Nature is a Business Cost." Their strengths lie in technology and management agility, though they are concerned about double standards in law enforcement and policy uncertainty.

3) Civil Society & Communities (co-managers): These are strong and seek to shift their status from beneficiaries to "co-managers" with rights to manage and fairly benefit from local resources.

Prioritized PPP Opportunities based on contextual analysis. High-potential opportunities for PPPs are identified in three key areas:

1) Ridge Conservation (forests & headwaters): Transforming conflict zones (potential mining concession areas in 4 districts) into new economic zones through "Eco-Geological Tourism," where the state grants community forest management rights while the private sector invests in green infrastructure.

2) Reef Restoration (marine ecosystems): Focusing on new financial mechanisms like the "Nature Repair Market" and Blue Carbon Credits. The private sector can purchase credits from seagrass and coral restoration to offset carbon footprints, coupled with upgrading co-management systems for marine patrolling.

3) Pollution Management: Considered the most urgent agenda. Key opportunities include "Utility Management Reform" by outsourcing wastewater treatment operations (O&M/BOT) to private experts and addressing island waste logistics bottlenecks through government subsidies for marine transport, enabling effective recycling on the mainland.

Policy Recommendations and Implementation Strategy to realize these opportunities. Reform of the "Policy Ecosystem" is required through four strategic pillars:

1) Establishment of a "Regulatory Sandbox": Designate Krabi as a pilot area with flexible regulations to facilitate special procurement methods (e.g., cross-island waste transport) and decentralize authority for conservation area usage.

2) Creation of sustainable governance institutional mechanism): Establish the "Krabi Sustainability Council" with a tripartite structure (Public-Private-People) to set long-term strategies and oversee PPP projects, ensuring continuity beyond political terms.

3) Financial Reform: Set up the "Krabi Green Fund" with financial independence, funded by Earmarked Green Fees from tourism and strict enforcement of the Polluter Pays Principle (using a "pay-as-you-throw" model) to incentivize pollution reduction.

4) Data-Driven Decision Making: Develop a central Environmental Intelligence Platform integrating satellite and Smart Environment data for precise law enforcement, transparency, and the certification of green businesses to award incentive

1. Overview of the Study Area and Environmental Situation in Krabi Province

1.1 Key Ecosystems of Krabi

Krabi Province is distinguished by its geographical prominence and abundance of natural resources, characterized by diverse physical features ranging from high mountain ranges serving as upstream forests to a coastline approximately 160 kilometers long. This biodiversity creates several important interconnected ecosystems, which are protected under legal measures and relevant Cabinet resolutions (Ministry of Natural Resources and Environment, 2016, pp. 1-8), as follows:

1. Upper Watershed Forests and Forest Resources

The forest condition of Krabi Province is critically important for maintaining natural balance. The total fertile forest area is 615,400 rai (98,464 Hectares), accounting for 20.91% of the province's area. The forests are predominantly tropical rainforests and mixed deciduous forests, which function as vital headwater sources. In terms of management and conservation, the Krabi Provincial Comprehensive Plan (2016) designated forest conservation land (light green with white diagonal lines) specifically to preserve and protect forests, wildlife, and headwater streams.

In the Ao Nang sub-district area, the topography consists of complex limestone mountains. Steep mountain areas, such as Khao Hang Nak and Khao Ao Nang, are home to significant "tropical rainforests." Although the characteristics of plant species in limestone areas may be stunted, they maintain biodiversity, with important species found such as *Hopea odorata* (Takian Hin), *Hopea odorata* (Takian Thong), *Dipterocarpus alatus* (Yang), and *Shorea roxburghii* (Payom). These areas have been declared National Reserved Forests, such as Ao Nang Forest and Hang Nak Forest, to conserve the forest condition and natural resources.

2. Mangrove Forest and Wetland Ecosystems

Wetland and mangrove ecosystems are the heart of Krabi's coastal resources. Mangrove forests cover 5 districts: Mueang Krabi, Ao Luek, Nuea Khlong, Khlong Thom, and Ko Lanta, totaling approximately 221,900 rai (35,504 Hectares). A globally significant area is the "Krabi River Estuary Wetland," covering 133,120 rai (21,299 Hectares). It is registered as a Wetland of International Importance (Ramsar Site). It was listed no. 1,100 of RAMSAR sites in the world and No. 4 in Thailand, consisting of mangrove forests and mudflats. Mangrove forests in Krabi contain at least 19 mangrove species.

In Ao Nang Sub-district, Mueang Krabi District, mangrove forests cover approximately 9 square kilometers, or 15% of the land area within the National Park. The main species found include *Rhizophora* (Kongkang), Avicennia (Samae), *Xylocarpus* (Tabhoon), Bruguiera parviflora (Thua Dam), and *Bruguiera cylindrica* (Thua Khao). Additionally, peat swamp forests with dense *Melaleuca cajuputi* (Samet Khao) stands are found around Noppharat Thara Beach, serving as a crucial transitional ecosystem between land and sea (Ao Nang Subdistrict Administrative Organization, 2021, 11-14).

In 2024, a pilot project was initiated to create economic mechanisms and incentives for wetland conservation, focusing on protecting the habitat of the Great Knot. The Great Knot is the largest shorebird in the genus *Calidris*,

a migratory bird traveling from breeding grounds in Eastern Siberia, currently classified as Endangered globally. The habitat includes other migratory waterbirds that use the Krabi River estuary mudflats as a vital stopover.

Mangrove Situation and Management (2024-2025): Krabi is a strategic area for the country's mangrove conservation. On May 10, 2024, Krabi was selected to host National Mangrove Day 2024, launching the Thailand Mangrove Alliance network. This collaboration between the government and over 30 private organizations promote mangrove planting for Carbon Credits, aiming towards the country's Net Zero goal (Krabi PAO, 2024).

Krabi continuously implements projects to plant mangrove forests to honor the monarchy and develops mangrove learning centers. Examples include promoting the Ban Nai Nang Stingless Bee conservation learning center (Muang District), promoting community-managed mangrove forests as eco-tourism and local history sites, and mangrove restoration projects in Koh Lanta District (Thung Thale Forest Project) to create food security and income for the community.

3. Marine and Coastal Ecosystems (Seagrass and Coral)

Krabi's marine resources, especially coral reefs and seagrass beds, play a vital role as nurseries for aquatic animals and food sources for rare marine species. The Krabi River estuary wetland is a large seagrass bed serving as a critical food source for dugongs, reflecting the abundance of biodiversity in the ecosystem.

Seagrass ecosystems in Krabi, which are linked to mangroves, are in a recovery phase. Recent survey data from late 2024 to early 2025 indicates signs of recovery for some seagrass species, such as Halophila ovalis (Spoon seagrass) and Cymodocea rotundata (Ribbon seagrass), in the "Ao Nam Mao" area of Krabi, after experiencing degradation in the previous year (Department of Marine and Coastal Resources, 2025).

Drone surveys in early 2025 in the Trang-Krabi boundary area (Koh Libong and nearby areas) found a dugong population of 49-56 individuals, a slight increase from the previous year. However, evidence of illegal hunting (cutting tusks/heads) is still found in Krabi Province, prompting relevant agencies to urgently define intensive protection measures.

To protect these resources, Krabi's coastal areas are designated as Environmental Protection Areas. Strict measures prohibit collecting or destroying coral, coral debris, sea fans, and seagrass, including prohibiting anchoring in areas with coral reefs and natural underwater rock piles. The Ao Nang Subdistrict Administrative Organization has implemented a mooring buoy project to prevent coral destruction from tourist boat anchoring.

4. Protected Areas by Law

Krabi Province has several types of legally declared protected areas to conserve biodiversity:

- **National Parks:** There are 4 national parks: Khao Phanom Bencha National Park, Hat Noppharat Thara-Mu Ko Phi Phi National Park (covering the Ao Nang area), Mu Koh Lanta National Park, and Than Bok Khorani National Park, totaling 422,512 rai (67,602 Hectares).
- **Wildlife Sanctuaries:** There are 2 sanctuaries: Khlong Phraya Wildlife Sanctuary and Khao Pra-Bang Khram Wildlife Sanctuary.

- **National Reserved Forests:** There are 45 forests totaling 1,415,952 rai (226,552 Hectares) before ALRO allocation. For example, Ao Nang Forest and Hang Nak Forest were declared National Reserved Forests to conserve forest conditions, timber, and natural resources (Gen. J. Navisathien, 1967, pp. 8-10).

1.2 Key Environmental Problems and Impacts

Environmental Challenges in Krabi and Ao Nang

Krabi is a province distinguished by its natural resources, both terrestrial and marine, under the visions of "International Quality Tourism City" and the "Krabi Goes Green" policy. However, the rapid growth of the tourism sector and urban expansion have directly impacted natural resources and the environment, causing complex problems that challenge management, especially in the main tourist area of Ao Nang Sub-district, a key destination for global tourists.

Ao Nang Sub-district, Mueang District, Krabi Province, features a landscape of limestone mountains interspersed with mangrove forests adjacent to the sea. It possesses fragile and important ecosystems, including headwater forests, mangroves, coral reefs, and seagrass beds. Economic development primarily reliant on tourism has created pressure on these resources in several dimensions:

1. Land Use Change and Encroachment on Natural Areas:

The expansion of the accommodation and restaurant service sector has caused rapid changes in land use conditions. Community and building areas have expanded while agricultural areas have decreased. A significant problem found is the encroachment on forest areas and national parks to build residences and businesses. Although the Ministerial Regulation on Krabi Provincial Comprehensive Plan designates land types for forest conservation and environmental conservation for tourism, the demand for space to accommodate the massive number of tourists (especially pre-COVID-19 and during the recovery in 2022) remains an accelerating factor for natural area encroachment (Ao Nang Subdistrict Administrative Organization, 2021, p. 9 and interview data).

2. Impacts from Marine Tourism Activities:

Dense tourism activities in Ao Nang, Koh Phi Phi, and nearby islands directly impact marine ecosystems. Problems found include:

- **Damage to Coral Reefs and Seagrass:** Caused by anchoring of tour boats in coral reef areas, sea walking activities, and glass-bottom boats impacting the seabed. Despite prohibitions and mooring buoy placement, accumulated damage remains visible, especially in the Koh Phi Phi area, which shows a trend of long-term severe damage.
- **Disturbance of Marine Animals:** Heavy water traffic affects the habitats of rare marine animals such as dugongs and sea turtles, including the presence of plastic waste and abandoned fishing gear that harm these animals (Ministry of Natural Resources and Environment, 2021, pp. 1-3).

3. Structural Problems and Operator Attitudes in Ao Nang:

In-depth interviews with executives of the Ao Nang Subdistrict Administrative Organization (SAO) revealed that the deep-rooted problem of environmental management in the area is "ownership." Since most operators in Ao Nang are investors or tenants from outside the area (e.g., from Phuket or foreigners) who come to do business for profit, there is a lack of attachment and consciousness regarding long-term environmental care. Awareness of problems among the majority is still very low; they often neglect pollution treatment system maintenance over time or fail to urgently repair equipment when it malfunctions.

Pollution from Solid Waste

The solid waste problem is a major crisis for Krabi Province, particularly in marine tourism areas with limitations on collection and transport. The solid waste situation correlates directly with the increasing number of tourists.

1. Waste Quantity and Management Situation

In 2022, Krabi generated an average of approximately 495 tons of solid waste per day, an increase from the previous year following the tourism recovery. The areas with the highest waste generation are Krabi Town Municipality (approx. 42.83 tons/day) and Ao Nang SAO (approx. 38.61 tons/day).

- **Ao Nang Area:** Waste volume in Ao Nang, Koh Phi Phi, and Railay Beach fluctuates with the tourism season. In 2022, waste volume increased by 51.61% from the previous year, with the majority coming from Ao Nang, followed by Koh Phi Phi. Waste management on Koh Phi Phi is challenging and costly due to the need for boat transport to the mainland for disposal at the Krabi Town Municipality Community Waste Power Plant, incurring private outsourcing costs of over 11 million Baht per year.

- **Disposal Limitations:** Although Krabi has a community waste power plant at Krabi Town Municipality that disposes of waste correctly according to academic principles, it does not yet cover all waste in the province. The majority of solid waste (36%) is still disposed of incorrectly (e.g., open dumping), and another 37% is utilized. A significant problem is that many Local Administrative Organizations (LAOs) lack the budget to transport waste across areas for disposal at the center, as well as limitations in personnel and garbage trucks insufficient for the volume of waste generated, especially during rush hours when racing against time before shops open.

2. Composition and Types of Problematic Waste

- **Organic Waste (Food Waste):** Accounts for the largest proportion of waste in tourism areas (e.g., Koh Lanta found organic waste as high as 43.70%) because many restaurants and hotels still lack effective food waste separation, making the waste smelly and difficult to manage.

- **Plastic Waste and Marine Debris:** Single-use plastic remains a huge problem, especially plastic bottles, bags, and foam, which are often found as residue in coastal ecosystems and islands. These wastes not only spoil the scenery but also break down into microplastics, contaminating the food chain and affecting marine animals and human health. Data from beach cleanups on Koh Rok found that "plastic bottles" were the most common waste (21.83%), followed by shoes and ropes.

3. Waste Management Clusters:

To solve waste management efficiency problems, the Krabi Provincial Solid Waste Management Committee resolved in September 2023 to improve the cluster model for waste management, reducing it to only 1 cluster with Krabi Town Municipality as the main host, covering all LAOs in the province. This aims to centralize waste disposal at the waste power plant, solving problems for small LAOs (e.g., in Koh Lanta or Khlong Thom districts) that lack the potential to establish their own disposal plants and face full landfill issues (Report on Solid Waste Situation in Marine and Coastal Tourism Areas, Krabi Province, 2023).

Pollution from Wastewater

Wastewater issues in Ao Nang are considered an environmental "time bomb" because infrastructure systems cannot adequately support urban and tourism expansion, resulting in wastewater from communities and establishments flowing into natural water sources and the sea.

1. Sources of Wastewater and On-site Problems:

In-depth interviews with Ao Nang SAO officials revealed key problems from various sources:

- **Hotels and Accommodation:** Large hotels usually have wastewater treatment systems as required by law but lack continuity in system operation and maintenance. Knowledgeable technicians often resign or are poached, leading to neglected treatment systems or "cheating" by not running the system to reduce costs.
- **Small commercial units or business and Restaurants:** Many restaurants have limited space and cannot install grease traps large enough for the customer volume (which can be hundreds per meal), causing grease to overflow the system and clog drains, resulting in wastewater flowing into public waterways.
- **Laundry Shops/ Laundromat:** A significant but overlooked source of wastewater. Many small laundry shops and coin-operated machines lack specific treatment systems for washing wastewater. They often use only septic tanks, which cannot treat chemicals from detergents and fabric softeners, causing chemical-contaminated effluent to flow into natural water sources.

2. Specific Wastewater Problem Spots in Ao Nang:

- **Klong Jaak:** A critical point where wastewater often flows into the sea. The canal mouth area is lower than sea level, causing stagnant rotten water mixed with sand sediment. Despite the installation of an electromagnetic treatment system, the wastewater volume exceeds capacity, so black water sometimes still flows onto the beach, severely affecting the tourism image.

- **Klong Ying Suea:** An area that **still has no central wastewater treatment system at all**. Most wastewater comes from households and flow directly into the sea.

3. Contamination of Groundwater and Sea:

There is concern regarding wastewater contamination into groundwater and seepage into the sea, especially in areas using soak pit systems in sandy soil such as Ko Phi Phi, Railay, and Ao Nang. There have been reports of detecting fecal coliform bacteria contamination in seawater around Railay and Koh Phi Phi, suspected to be

caused by wastewater seepage from establishments discharging into the ground nearby or illegal discharge of sewage directly into the sea.

1.3 Key Policies and Initiatives on Environment and the Role of Government and Private Sectors

Environmental Protection Measures, Development Strategies, Ao Nang SAO Ordinances

1. Environmental Protection Measures (Ministry of Natural Resources and Environment Announcement) are the main legal tools defining scope and restrictions on land and resource use in sensitive areas of Krabi.

Operators: Relevant at multiple levels.

- **Policy and Enactment Level:** The Minister of Natural Resources and Environment signs and enacts measures based on the National Environment Board's proposal.
- **Supervisory Level:** The National Environment Board and the Governor of Krabi Province play roles in supervision and defining enforcement details in the area.
- **Enforcement and Operational Level:** Local Administrative Organizations (LAOs) in the area (e.g., Ao Nang SAO) and Pollution Control Officers (who may be PONRE or assigned LAO officials) have the power to inspect, control, and enforce measures defined in the announcement in practice.

The objective is to maintain the balance of ecosystems and natural resources in fragile economic areas for:

1. Preserving and Restoring Environmental Quality: Focusing on protecting environmental quality and natural resources in declared areas, especially coasts, islands, and key tourist sites essential to the provincial economy.

2. Controlling Land Use and Activities: To strictly control and limit usage in protected areas, such as building heights, land use near water sources, and permitting activities that may impact the environment.

3. Setting Pollution Standards: Defining strict standards for water pollution discharge (effluent) and waste management to ensure development does not impact on the overall ecosystem.

2. Development Strategies (Provincial/Local Level): Medium or long-term roadmaps used by provincial or local agencies, often linking national policies to local problems.

Operators:

- **Provincial Level:** The Provincial Administrative Organization (PAO) and Provincial Development Committee prepare and supervise strategies covering the whole province, especially tourism direction and resource management.
- **Local Level:** Ao Nang Subdistrict Administrative Organization (SAO) adapts and integrates provincial strategies into its local development plan.

The objective is to create a sustainable working framework:

1) Promoting Sustainable Tourism: To promote eco-tourism and nature conservation alongside stable economic income generation.

2) Integrated Resource Management: Focusing on sustainable natural resource management, prioritizing control of tourism impacts (e.g., solid waste and wastewater).

3) Linking Law to Practice: Acting as a mechanism to link environmental protection measures (law) into plans/projects (practice) that can actually be allocated budget and resources in the area.

4) Quality of Life Development: Including objectives to improve local people's quality of life alongside environmental conservation.

3. Ao Nang SAO Ordinances (Local Level): Local laws drafted to enforce and manage specific problems in the area effectively.

Operators: Ideally Ao Nang SAO.

- **Drafters and Enactors:** Executives and Members of the Ao Nang SAO Council consider drafting and voting to enact ordinances.
- **Main Enforcers:** Ao Nang SAO and assigned officials (e.g., fee collectors, public health staff) are responsible for daily enforcement.

The objective is to solve immediate problems and create financial mechanisms:

1) Solid Waste and Wastewater Management: To control the management of solid waste and sewage in the area to comply with sanitation and regulations, especially to solve accumulated waste problems and overflowing trash affecting the tourism image.

2) Fee Collection: To create sustainable financial mechanisms for managing local public services, such as setting rates for waste collection fees and wastewater treatment fees.

3) Controlling Construction in Specific Areas: Controlling construction and other activities in especially sensitive areas according to Environmental Protection Measures requirements to ensure strict law enforcement most appropriate for Ao Nang's context.

1.4 Projects Driving PPP Mechanisms in Krabi Province

Driving PPP mechanisms in Krabi focuses on integrating cooperation between the government, private sector, NGOs, and civil society to conserve and restore ecosystems linking headwaters to the sea. Operations align with the Krabi Provincial Development Strategy and comply with the Ministry of Natural Resources and Environment Announcement. Key projects are discussed below.

Krabi Goes Green

"Krabi Goes Green**:** Towards a 100% Renewable Energy Model City**"** is a research and policy advocacy project with the main goal of transitioning Krabi's energy system from fossil fuel dependence (coal and oil) to 100% clean and sustainable Renewable Energy within a set timeframe. This project arose from the cooperation of the academic sector, civil society, local government, and the private sector to respond to global warming trends and SDGs, aiming to prove that Krabi has sufficient potential to rely on itself for electricity from local resources.

The project has the following key objectives:

1. To develop a long-term electricity generation and consumption plan (20 years). This will a study of actual electricity consumption data in Krabi Province in order to plan power generation for the period of 2018–2037 (B.E. 2561–2580) in alignment with demand.

2. To assess local renewable energy potential. This requires a study and analysis of the electricity generation capacity from five types of renewable energy sources available in Krabi Province, namely biomass, biogas, solar, wind, and mini-hydro.

3. To establish a 100% Clean Energy Model City. The task is to evaluate the technical and economic feasibility of developing Krabi into a model province capable of energy self-reliance through 100% clean energy, without dependence on new coal-fired power plants.

4. To support Sustainable Development Goals (SDGs). Project operations align with at least 6 out of the 17 United Nations Sustainable Development Goals, including access to clean energy and climate action.

A "Multi-stakeholder Partnership" comprising 4 operator main sectors: Academic Institutions, NGOs, Local Government, and the Tourism Private Sector.

- **Local Government:** Krabi PAO.
- **Private Sector:** Krabi Tourism Industry Council.
- **Civil Society/Community:** Pakasai Protection Group and National Oil Palm Policy Committee.
- **Support Networks:** Krabi Goes Green Network, Andaman Goes Green, supported by Greenpeace Thailand.

The key achievement of the Krabi Goes Green project is the development of a master plan demonstrating that Krabi Province possesses a combined renewable energy potential—including biomass, biogas, and solar—of up to 1,676 megawatts. This capacity exceeds the province's peak electricity demand by several fold. Simulation results indicate that with appropriate policy support, Krabi could develop into a model city fully powered by 100% renewable energy, 24 hours a day, in 2026. Furthermore, a 20-year long-term economic cost-benefit analysis revealed that this approach entails lower total costs and generates greater benefits for the local economy compared to reliance on fossil fuels.

The Krabi Goes Green project represents a significant milestone in establishing the academic and policy foundation to transform Krabi's identity. Beyond its status as a world-class tourist destination, the project aims to position Krabi as Thailand's clean energy capital, driven by strong cooperation across all local sectors as the key mechanism for change.

Krabi Rewild

"Krabi Rewild" is a festival putting the "Rewild" concept into practice. It is not just a festival but a social and environmental movement focusing on "returning balance to nature" (rewilding) through learning processes, art creation, and practical action. It aims to reconnect humans with nature and raise awareness of the environmental crisis among local communities, tourists, and operators in Krabi.

The project has the following key objectives:

1. To build awareness and instill environmental consciousness (Awareness & Education): This involves focusing on educating the general public and tourists about the importance of natural resource conservation, plastic waste reduction, and proper waste management through accessible and entertaining activities, such as art workshops and panel discussions.

2. To promote community participation and networking (Community Engagement): The organizers aim to create a "Platform" that provides opportunities for local artists, conservationists, entrepreneurs, and the community to collaborate, exchange knowledge, and build strong cooperative networks to drive environmental issues together, moving away from fragmented individual efforts.

3. To promote the image of green tourism (Green Tourism Promotion): The goal is to pushing "Krabi Rewild" to become an annual event that attracts quality, environmentally conscious tourists and reinforces Krabi's image as a sustainable eco-tourism destination.

4. To support the circular economy (Circular Economy Support). This will achieved by promoting resource reuse and supporting small-scale entrepreneurs who offer eco-friendly products or services, providing them with channels for distribution and product promotion.

Krabi Rewild operates through a distinctive 'multi-stakeholder partnership.' While the private sector and civil society act as the core organizers, the initiative is supported by government agencies such as the Department of Marine and Coastal Resources and the Royal Forest Department. The project also encompasses a wide network of partners, ranging from communities practicing sustainable management and regional health networks to local educational institutions.

The core operation is driven by a collaboration between civil society organizations and social enterprises, including:

- **Nature Mind-ED:** Acts as the main organizer, playing a key role in driving concepts, designing learning activities, and coordinating environmental and educational aspects.
- **Private Sector Collaboration:** Key partners include hotel groups, the Krabi Hotel Association, and local businesses such as Nasook Wellness Resort, Panan Krabi Resort, Varana Hotel, and The Tubkaak Krabi Boutique Resort, which provide support in terms of venues and resources.
- **The Government Sector will participate as supporters and facilitators rather than main organizers, with details as follows:**
    - **Ao Nang Subdistrict Administrative Organization (SAO):** Supports as the Land Owner, as activities are often held in public areas or beaches under the SAO's supervision. They also facilitate cleanliness and area management.
    - **Krabi Province:** Supports in terms of Policy and Image. The Krabi Rewild project aligns with the province's "Krabi Goes Green" strategy, helping to promote the image of green tourism.
    - **Department of Marine and Coastal Resources (DMCR):** (Participates as a relevant authority).
    - **Tourism Authority of Thailand (TAT) Krabi Office:** Supports as a promotion partner in PR and marketing to communicate activities to target tourist groups and attract participants, aligning with eco-tourism promotion plans.

Activities and Format. The Krabi Rewild project drives activities in an "Edutainment" format that blends art, music, and conservation to create fun and accessible learning experiences.

Main Activities:

- **Hands-on workshop zones** such as natural tie-dye and making beeswax food wraps (Bee Wrap), alongside art exhibitions featuring over 20 artists, knowledge exchange panels, and musical performances to create atmosphere.
- **Green Market:** Features a market focusing on plastic-free packaging.

• **Highlight:** A key collaboration with N15 Technology in the "Orphan Waste Mobile" activity, which opens donation points for non-valuable plastic waste to be converted into alternative energy (Refuse Derived Fuel - RDF), concretely reducing the amount of waste sent to landfill.

Goals in 2025 (November 5–7), the project aims to elevate itself into an international Eco-Festival Model.

• **Expansion:** Plans include expanding the venue to Noppharat Thara Beach to accommodate more participants and extending the duration from 2 to 3 days.

• **New Activities:** Increasing the diversity of activities, such as beach yoga, children's art contests, and recycled parades, to attract foreign tourists and reinforce Krabi's image as a green tourism destination.

Project Significance: Krabi Rewild is a success story of an environmental initiative driven by the private sector with cooperation from all sectors. The project focuses not merely on solving waste problems at the end of the pipeline, but on "creating a new culture" through art and entertainment. This approach aims to deeply ingrain environmental consciousness in people's hearts, serving as a key to the sustainable development of Krabi's tourism.

Koh Lanta Declaration: Blue & Green Island

Koh Lanta District is a world-class destination distinguished by natural resources (Blue & Green). Tourism growth has brought waste and emission problems. The "Koh Lanta Declaration" initiative drives Koh Lanta towards a Blue & Green Island and Net Zero Tourism.

It involves gathering government, private, and personal networks to sign the declaration to protect natural resources, focusing on waste management at the source and carbon reduction.

The core operation is driven by a collaboration organizations, including:

• **Government (Director):** Krabi Province (Governor), Koh Lanta District (Sheriff), and 6 Local Administrative Organizations (Municipalities/SAOs) as main operational units.

• **Private Sector (Action Driver):** Koh Lanta Tourism Business Association, Hotel/Resort operators (Green Hotels), Private partners (waste management companies like Wongpanit/N15).

• **Civil Society/Academic:** Krabi Carbon Neutral Network, Healthy Public Policy Foundation.

The Koh Lanta Declaration project is regarded as a social innovation driven by local cooperation (bottom-up), with the government sector acting as a supporter (policy support). This project holds a clear objective to preserve Koh Lanta's natural capital (Blue & Green) for sustainable tourism. Its implementation has established a new norm for tourism city management, specifically by engaging all sectors to share responsibility in carbon reduction and waste management. This lays a vital foundation for Krabi Province to achieve its goal of becoming a net zero carbon tourism city in the future.

Save Krabi Hills Group (Khon Rak Khao Krabi)

The Save Krabi Hills Group (Khon Rak Khao Krabi) originated from a gathering of the people's sector in four districts of Krabi Province: Mueang, Lam Thap, Ao Luek, and Plai Phraya. These areas have been directly and continuously affected for years by attempts to push for mountain blasting concessions for industrial rock mining (Dolomite). The movement began as small local groups before elevating to a joint provincial network in 2022.

The group's ultimate goal is to "Remove Krabi areas from the Mineral Master Plan," with the following objectives and missions:

- **Resource Protection:** To oppose mountain blasting and demand the suspension of all blasting approvals pending fact-finding studies. This includes demanding the removal of mountain areas in the four districts from the Mineral Master Plan if studies clearly indicate they are headwater sources or archaeological sites, in accordance with the Minerals Act B.E. 2560 (2017).
- **Sustainable Management:** To push for natural resource management that emphasizes value creation alongside conservation (e.g., eco-tourism) to resolve conflicts and balance community rights with the economy.
- **Social and Network:** To connect people and strengthen the civil sector with knowledge regarding rights and information to stop projects at the local level, and to raise public awareness of the value of mountain and cave resources.
- **Policy:** To establish a new norm for national resource management and participate in defining the future development of the area in alignment with the "Krabi Green & Sustainable" vision.

Leadership The movement is driven by civil sector leaders combined with cooperation from specialized advisors. Key leaders include:

- **Mr. Phisit Petthong:** President of the Save Krabi Hills Group.
- **Mr. Niwat Wattanayommanaporn:** Advisor to the Krabi Cave Lovers Club and representative of the Save Krabi Hills Group (Expert in cave exploration and archaeology).
- **Mr. Mano Krueakaew and Mr. Thanawat Phukaoluan:** Representatives of the Phanom Bencha Conservation Group (Joint movers on headwater forest and Khao Kai Khia issues).

Key Partnerships: The Save Krabi Hills Group is distinguished by building cooperation with various sectors to drive work systematically, including:

- **Private Sector (Key Alliance):** The tourism business group acts as a main ally, as they seek to protect natural resources which are tourism capital. This includes the Krabi Chamber of Commerce, the Krabi Tourism Industry Council, the Krabi Hotel Association, and the Krabi Tourism Business Association.
- **Political Sector:** Efforts are made to coordinate and build cooperation, seeking support from Members of Parliament (MPs) in Krabi Province from both the Bhumjaithai Party (Mr. Kitti Kittithonkul, Mr. Saritpong Kiewkhong, Mr. Thiradet Tangmankokit) and the People's Party (Mr. Prasertpong Sornnuvat) to receive complaints and present them to the government.
- **Government and Administrative Sector:** Coordination with the Provincial Governor (as the Provincial Mineral Committee), the Provincial Industry Office, the Provincial Office of Natural Resources and Environment, and Than Bok Khorani National Park.
- **Civil Society:** The Provincial Community Organization Council, Community Tourism Groups, and the Krabi Provincial Farmers Council.

Key Leaders: Mr. Phisit Petthong, Mr. Niwat Wattanayommanaporn (Cave/Archaeology expert), representatives from the Phanom Bencha Conservation Group.

Movements and Methods

In Krabi Province:

- **Submission of Petitions:** Conducted tours to submit letters to local government agencies, such as the Provincial Industry Office, the Provincial Governor, and the Provincial Administrative Organization, to declare their intent to oppose the projects.
- **Creating Public Awareness:** Organized academic seminars, exhibitions displaying photography of Krabi's beautiful caves, and cave tourism trips to communicate the potential for tourism rather than mining to society.
- **Field Surveys:** Collaborated with forestry officials to inspect forest areas (e.g., Manora Cave and Khao Kai Khia), leading to the suspension of forest clearing after discovering the richness of the forest and archaeological artifacts.

In Bangkok (Government House):

- **Rallies:** Staged rallies and encampments in front of the Government House to directly pressure policy-level executives.

Timeline of Events:

2022 (Inception): Gathered to submit letters of intent to provincial-level agencies to oppose mountain blasting projects.

2023 (Campaigning): Focused on proactive activities to raise awareness, organizing photo exhibitions and cave tours to attract mass participation and private sector involvement.

2024 (Policy Push - Prime Minister Srettha's Government): Mobilized a rally at the Government House, successfully pushing for the issuance of Prime Minister's Office Order No. 143/2567 (signed by Mr. Srettha Thavisin) to establish a committee for problem-solving and fact-finding.

2025 (Reclaiming Promises - Prime Minister Anutin's Government):

- Since the previous order lost validity following the change of government, the group rallied again between October 20–22, 2025 at the Government House.
- Achievement: Received a new Prime Minister's Office Order signed by Mr. Anutin Charnvirakul on October 22, 2025, to proceed with the committee for solving problems in the mountain areas of the 4 districts.

Currently, the Save Krabi Hills Group has achieved success at the policy level, successfully suspending certain operations and establishing a national-level fact-finding committee. However, the group is currently monitoring the study results to achieve their ultimate goal: permanently removing the areas from the Mineral Master Plan and advocating for area development through PPPs (Public-Private Partnerships) focused on eco-tourism and conservation instead.

Waste is Not Orphan Project (Khaya Mai Kam Phra)

"Orphan Waste" (Khaya Kam Phra) is the definition given to waste that cannot be recycled, holds no market value, and is rejected by junk shops or informal waste collectors (*Sa-leng or side car*). Consequently, this waste is typically disposed of via landfilling, leading to accumulated pollution and greenhouse gas emissions. Examples

of orphan waste include snack wrappers, plastic food bags (curry bags), fabric softener pouches, old toothbrushes, pens, multi-layer plastics, and food cling wrap.

The "Waste is Not Orphan" project was initiated to "find a home" for this waste by transforming it from valueless trash into alternative energy. This serves as a critical approach to reducing residual waste in Krabi Province.

The project has key objectives covering both environmental and social dimensions, as follows:

1. **To reduce waste to landfill:** The ultimate goal is to divert waste from landfill to combustion processes for alternative energy. Landfilling these plastics not only wastes space but also poses long-term threats, as plastics take 400–500 years to decompose and eventually break down into microplastics, contaminating the environment.

2. **To process waste to energy:** The project focuses on utilizing combustible but non-recyclable waste for maximum benefit by converting it into Refuse Derived Fuel (RDF). This RDF is used in cement kilns, which operate at temperatures as high as 1,450 degrees Celsius. Combustion at this temperature can completely eliminate toxins and dioxins while helping to reduce the use of fossil fuels (coal) in the cement industry.

3. **To build awareness and change behavior:** The project aims to instill environmental consciousness in hotel staff, the public, and tourists. It seeks to educate them on waste types and the value of waste separation, demonstrating that even non-marketable waste has a "place to go" and utility if managed correctly.

Project Operators and Network Partners: The project operates through a "Collaboration between the Private Sector and Environmental Networks" as follows:

- **End Destination and Technical Initiator:** N15 Technology Co., Ltd. N15 Technology serves as the core "destination" for orphan waste. The company manages waste and unused materials, taking the collected orphan waste through sorting, shredding, and processing into Refuse Derived Fuel (RDF) to replace coal in cement kilns.
- **Local Driver:** Green Hotel Network (Krabi) At the provincial level, the project is driven by a group of hotel operators with sustainability policies. Ms. Rapeepan Pukaoluan (from interview data) serves as a key representative from the hotel business sector (e.g., Ao Nang Princeville Villa Resort and Spa).

Local Partner: Wongpanit (Nuea Khlong Branch) Wongpanit plays a vital role as a "Local Cooperative Partner" with two main functions:

- **Buying Recyclables:** Purchasing general recyclable waste according to normal market mechanisms.
- **Managing Orphan Waste:** Acting as a collection point for "Orphan Waste" (e.g., plastic films, tissue wrapping) to be sent for RDF production.
- **Significance:** The involvement of Wongpanit helps solve "Logistics" and "Collection Point" issues. It allows hotels and communities to conveniently enter orphan waste into the system using the existing infrastructure of local recycling shops.

Local partner: Eco-friendly Hotel Network (Green Hotel): At the Krabi provincial level, this project is driven by a group of hotel operators committed to sustainability policies. "Khun May" (from interview data) serves as one

of the operational representatives from the hotel business sector (e.g., Ao Nang Princeville Villa Resort and Spa), acting as a focal point for collection and source separation.

Linkage to Provincial Activities The project also connects with provincial-level events, such as "Krabi Rewild," which serves as a venue for "Mobile Orphan Waste" donation drives, providing opportunities for the general public to bring their waste to participate in the project.

2. Analysis and Assessment of Opportunities for Public-Private Partnerships (PPPs) in Conservation, Mitigation, and Restoration of Degraded Habitats in Headwater Forests and Restoration and Protection of Nearshore Marine and Coastal Ecosystems in Krabi Province

Krabi Province is entering a significant transition period, moving from a world-class mass tourism destination towards becoming a model for "Regenerative Tourism" under the "Krabi Go Green" and "Krabi Prototype"1 strategies. These strategies aim to balance economic growth with the protection of fragile natural resource bases. However, amidst the climate crisis and intensifying accumulated pollution problems, relying solely on government mechanisms or fragmented operations can no longer timely address these challenges. Creating synergy in the form of Public-Private Partnerships (PPPs) is not merely an option, but a survival strategy to mobilize resources, technology, and wisdom from all sectors to protect and restore ecosystems, from headwater mountain ranges to the sea, ensuring they remain the lifeblood and economic capital for the people of Krabi.

This analysis is derived from surveys, opportunity assessments, and aims to describe the nature of creating such collaborations. It delves into the structure and relevance of key stakeholders (through stakeholder analysis), where many sectors hope to see the government shift its role to become a facilitator, the private sector contributing its readiness in innovation and agility, and the civil society sector desiring rights to care for resources and manage Krabi's environment.

The synthesis forms concrete partnership models in 3 main dimensions: conservation of headwater forest areas, restoration of marine and coastal ecosystems, and comprehensive pollution management. The content presented in this chapter aims to serve as a conceptual framework and policy recommendations to unlock existing limitations and drive a new form of natural resource management where all parties are true partners.

2.1 Stakeholder Analysis and Drivers for Establishing PPPs in Krabi Area

Government Agencies are considered key mechanisms acting as the "Main Facilitator" in laying the foundation and creating an environment conducive to PPPs. An analysis of Krabi's current context reveals that the government's role and readiness are undergoing significant changes to adapt to new development directions

[1] The “Krabi Prototype" is a model project for sustainable tourism development initiated by the Tourism Authority of Thailand (TAT). Krabi Province was selected as a Case Study area to serve as the foundation for drafting the national master plan, known as the "Thailand Green Tourism Plan 2030" (Explained by Ajarn Kaewta and TAT representatives at the Krabi Rewild 2025 event, December 5, 2025).

and resource management. Central and local agencies are attempting to shift from being solely rule enforcers to supporting other sectors' participation. However, in practice, they still face two major structural challenges and obstacles:

- **Efficiency and Continuity:** Despite policies supporting sustainable development, government operations at the local level still face efficiency and continuity issues. It is found that the work of some civil servants lacks coordination or is inconsistent. This problem often depends on the vision and attention of administrators in each aera. If an administrator has a clear vision and prioritizes the issue, work progresses quickly. However, with transfers or transitions of administrators, policies and support often lack continuity, causing the private sector to hesitate in long-term investment or cooperation due to the lack of guarantees for project sustainability.

- **Policy Conflicts and Implementation Gaps:** A major obstacle undermining the confidence of the private sector and civil society is the paradox between overall policy and actual practice, which significantly impacts the "Krabi Go Green" image (data from operator interviews). These include:
    - **Conservation Paradox:** While the province declares a stance on eco-tourism, mining concessions involving mountain blasting are permitted in areas near tourist sites or fragile areas, creating confusion for tourists and contradicting sustainable development directions.
    - **Non-incentivizing Fee Structures:** Wastewater treatment fee collection policies still use a "one size fits all" format, charging based on the number of rooms instead of actual wastewater volume, or lacking rebate measures for operators who already have standard wastewater treatment systems. This approach not only fails to incentivize environmental investment but also creates a redundant burden for responsible operators.

However, driving PPPs in the context of Krabi does not occur in a vacuum but is happening or has the opportunity to happen amidst a significant transition from "Nature-Based Tourism" to "Regenerative Tourism," with social alertness and challenging environmental crises. From the "Krabi Rewild Festival 2025" forum and related data, the roles, motivations, and dynamics of 3 main stakeholder groups—Government Agencies, Private Sector, and Non-Governmental Organizations (NGOs)—can be analyzed as follows:

1. Government Agencies

The government is considered the "Main Facilitator" in creating an environment conducive to PPPs. The role and readiness of the government in the Krabi context have changed significantly.

Roles

- **Transition from "Regulator" to "Facilitator":** Dr. Kongkiat Kittiwattanawong, an expert in marine and coastal ecosystem research (Department of Marine and Coastal Resources - DMCR)[2], pointed out a paradigm

[2] Krabi Rewild 2025 Forum: "Participatory Governance and Policy Innovation (Interactive Governance and Policies Innovation)," December 5, 2025

shift in government work. In the past, the government acted as a "Regulator" wielding a stick to supervise. But in the current complex context, the state must shift to being an "Enabler/Facilitator" opening opportunities for communities and the private sector to participate and use innovation to drive policy.

- **Creating a Legal Framework for Community Rights:** A key government role is laying the legal foundation, citing the Constitution Section 43, which recognizes the rights of individuals and communities to conserve, restore, and utilize natural resources. This is a crucial basis for legitimizing PPPs and giving communities the status of "Rights Holders," not just order followers.
- **Defining Provincial Strategic Direction:** The Governor of Krabi (Mr. Angkor Silatewakul) and the Tourism Authority of Thailand (TAT) play a role in defining the "Krabi Go Green" vision and elevating it to "Regenerative Development." This sends a clear signal to the private sector about the province's development direction, emboldening them to invest in eco-friendly projects.
- **Support and Creating Incentives:** Playing a role in certifying standards (e.g., Green Hotel) and supporting various benefits for operators who do good deeds.

Institutional Capacity

- **Capacity in Leadership and Policy:** Krabi has high readiness regarding top-level leaders who prioritize the environmental agenda, evidenced by the Governor participating in signing ceremonies and workshops (Commitment) in the Krabi Prototype project, and the existence of the "Krabi Tourism Declaration" driven for over a decade.
- **Capacity in Tools and Data:** Despite firm resolve, the government admits to limitations regarding data for forecasting the future (Foresight/Scenario Planning). Dr. Kongkiat admitted that existing 5-year or 20-year strategic plans might not be able to timely handle unthinkable/improbable events like seagrass die-offs or coral bleaching without accurate data.
- **Personnel capacity Constraints:** The government has workforce limitations. For example, the DMCR has only 500 staff to care for over 3,000 kilometers of coastline, making thorough care impossible. Thus, it is necessary to bring in the private sector and communities to fill this gap.

2. Private Sector

The private sector in Krabi, especially tourism businesses, hotels, and restaurants, are strong local operators acting as the "Main Engine" of Krabi's economy. Their drivers and motivations for joining PPPs mechanisms are as follows:

- **Risk to Business Survival:** The highest motivation for driving environmental work in the private sector is not just Corporate Social Responsibility (CSR) but economic survival. Private sector representatives, such as Ms. Wichuphan Phukaoluan (former President of the Krabi Hotel Association), realize that "Nature is a Business Cost." If resources degrade—e.g., coral dies or wastewater problems occur—it directly impacts income and tourist numbers, potentially causing business collapse. Restoring nature equates to protecting their assets and stability.

- **Lessons from Crises as Catalysts:** Experiences from the Tsunami and COVID-19 crises are key catalysts. The private sector learned that when crises occur, the government might not provide timely assistance. Having a strong cooperation network and self-reliance is paramount, leading to a demand for effective risk management systems through PPP mechanisms.
- **Need for System, Order, and Fairness:** The private sector wants to create standard systems so locals can pursue careers sustainably and reduce disparity from unfair competition, especially the problem of unlicensed businesses that do not invest in wastewater treatment, resulting in lower costs and undercutting legally compliant operators.
- **Value Creation and Financial Incentives:**
    - **Image:** Participating in projects like Krabi Rewild or Zero Waste Festival creates a "Green Destination" image, attracting High Value Tourists who care about the environment, consistent with global trends.
    - **Benefits:** The private sector wants tangible incentives to reduce the cost of doing good, such as tax benefits (Green Tax) or wastewater fee rebates if establishments can manage wastewater to standards themselves, as well as special marketing opportunities from Green Hotel certification.

Expertise

The private sector in Krabi has a strategic advantage from accumulated experience at the business and partly community levels, providing a set of expertise ready to support PPPs operations:

- **Agility in Management and Resource Mobilization:** The private sector excels in speed and readiness of budget and personnel that can be mobilized immediately without waiting for slow bureaucratic processes. This is seen in the success of the "Mai Khao Model" (Phuket) where 11 hotels pooled funds to hire beach cleaners. This aligns with Krabi operators' potential in mobilizing public funds and practical experience in effectively managing community utilities, such as village water systems, reflecting their ability to care for local infrastructure.
- **Creativity and Social Innovation:** Ability to practically apply Circular Economy concepts through initiating social innovation projects themselves, such as the "Waste is Not Orphan" project cooperating with Wongpanit to turn unwanted waste into fuel, upcycling plastic waste into products, and designing Low Carbon tourism routes. This demonstrates a vision for tangible environmental problem-solving.
- **Marketing and Data Management Expertise:** The private sector has high expertise in organizing events and marketing communication, seen in the success of the Krabi Rewild Festival which attracted domestic and international partners. Additionally, they work systematically through establishing "Green Teams" in organizations to collect detailed environmental data (e.g., waste volume, water usage) to aim for international standards, which is a key database the government can utilize.

Concerns

Although the private sector has potential and commitment, they face concerns acting as risk factors for long-term business sustainability and investment. These are key conditions requiring clarity and supporting mechanisms for genuine confidence in joining PPPs:

- **Uncertainty of Natural Disasters:** Concerns about more severe and unpredictable natural disasters (e.g., Hat Yai floods or rapid climate change) directly impacting infrastructure and tourism.
- **Lack of Decision-Making Data:** The private sector needs accurate scientific data (e.g., satellite data, advance weather forecasts) for business planning and risk response, but currently, this data is scattered or not communicated simply.
- **Policy Continuity:** Concerns that if the Governor or top executives change, environmental policies might stall. They require sustainable working structures (system-based) rather than attachment to individuals (Person-based).

3. Non-Governmental Organizations (NGOs) & Communities

NGOs and communities are stakeholders considered the 'heart of sustainability at the grassroots level' as they are on the ground and most directly affected.

Perspectives:

- **Nature is Life:** For local communities, especially the Urak Lawoi ethnic group, natural resources are not just tourist attractions but "Food Security" and "Way of Life." Losing biodiversity equals losing their wisdom and identity.
- **Partnership with Beneficiaries:** Communities do not want to be merely "aid recipients" or "order followers" but want to be "Partners" with management roles, as supported by the Constitution.

Need for Participation:

- **Acceptance of Local Wisdom:** Want traditional knowledge (e.g., observing wind directions, conservation-based fishing) blended with modern science in resource management.
- **Fair Income Distribution:** Want eco-tourism to return income to the community, such as fishermen becoming community tour guides or selling local products.
- **Communication Space:** Need channels to reflect impact problems (e.g., dying seagrass, disappearing dugongs) to the policy level because what locals see on the ground might not match academic data or government reports.

2.2 Assessment of Opportunities for Public-Private Partnerships (PPPs)

To create a sustainable balance between economic growth and protecting fragile natural resource bases amidst the intensifying climate crisis, creating cooperation mechanisms in the form of PPPs is not just an option to support government work but a "Survival Strategy." It helps mobilize resources, innovation, and management

capabilities from all sectors to handle environmental challenges too complex for government agencies to bear alone.

The analysis of local dynamics reveals that Krabi has high opportunities and feasibility for developing social and environmental joint venture projects. It has readiness in valuable natural resource capital and a strong private sector and civil society with a high Sense of Ownership in resources. The following opportunity assessment focuses on 3 main dimensions systematically linked by the "Ridge to Reef" concept: conserving and restoring headwater forests to maintain ecosystem stability from the source, protecting marine and coastal resources which are the province's key business assets, and upgrading pollution management with technology and circular economy models. This aims to ensure future development truly restores and creates sustainable shared wealth for all sectors.

Based on stakeholder potential analysis, opportunities for developing PPPs in Krabi have potential in 3 main areas:

1. Conservation, Mitigation, and Restoration of Degraded Habitats in Headwater Forest Areas

Up watershed forests and limestone mountains in Krabi, especially in the 4 districts (Mueang, Lam Thap, Ao Luek, Plai Phraya), are key ecological strategic points facing pressure from mining industry development. Assessing opportunities for PPPs here is not just about reforestation but "changing the resource management structure" from destructive extraction to sustainable utilization, relying on cooperation from 3 main sectors:

1.1 Context and Drivers: From "Conflict Zones" to "Green Economic Opportunity Zones"

Analysis shows that headwater forest and mountain areas in Krabi are shifting status from mining concession conflict zones to mutual conservation targets. Key drivers include:

- **Shared Crisis:** Attempts to push limestone mining concessions (Dolomite) catalyzed the gathering of the people's sector as the "Save Krabi Hills Group," joining forces with the Tourism Private Sector (Chamber of Commerce, Hotel Association, Tourism Industry Council). Both sides realize that if mountains are blasted, it directly impacts scenery, water sources, and the province's tourism capital.
- **Changing Value:** The private sector sees "Value" in mountains in a new dimension—not just as mineral sources but as "Unseen Tourist Attractions" (e.g., caves, prehistoric paintings, viewpoints) which can generate sustainable circulating income better than mineral royalties.

1.2 Assessment of Possible Partnership Models (PPPs Models)

From synthesizing the proposals and on-the-ground activities, we can define three key forms of Public-Private Partnerships (PPPs) appropriate for the Krabi upper watershed forest area

- **"Community-Private Forest Park Model":** This is the highest probability opportunity, already underway in some areas. It involves converting mining concession target areas into eco-tourism sites.
    - **Government Role (Royal Forest Dept./National Parks):** Shift from concession licensor to "Regulator and Rights Certifier" for establishing community forests or local parks, and supporting rangers in law enforcement.

- **Private Sector Role:** Invest in "Green Infrastructure" that the state may lack budget or agility for, such as cave lighting systems, safe nature trails, or designing low carbon tourism routes, in exchange for rights to manage some tourism services.
- **Community Role (Save Krabi Hills/Cave Lovers):** Act as area managers, local guides, and surveillance, using tourism income to establish a forest care fund instead of relying solely on state budget.

- **"Ridge to Reef Guardians Model":** Since the headwater areas of the 4 districts directly affect water quality and sediment flowing into the sea, restoration must link with downstream beneficiaries.
  - **Cooperation Opportunity:** Create PPP mechanisms linking marine tourism operators (Downstream) to support headwater conservation (Upstream) under the concept "Care for the Mountain to Protect the Coral."
  - **Working Mechanism:** The downstream private sector supports budget or technology (e.g., survey drones, camera traps) to the Phanom Bencha Conservation Group and Save Krabi Hills Group for patrolling against encroachment and poaching, reducing soil erosion that destroys marine ecosystems.
- **"Nature Repair Market & Biodiversity Credits Model":** A new opportunity that the policy-level private sector (e.g., Tourism Business Association, Provincial Joint Public-Private Consultative Committee[3]) is interested in to create financial sustainability.

Concept: Economic valuation of forests and mountains in the form of "Biodiversity Credits" or forest sector carbon credits.

- **Private Sector Role:** Large companies or hotels with Net Zero goals can "invest" or pay communities/forest restoration funds to offset their environmental impacts (nature negative to nature positive) without waiting for state enforcement measures.
- **Government Role:** Certify standards and verify project transparency to build investor confidence.

Although forum data focused heavily on coastal areas, the "Ridge to Reef" concept is significantly linked. Headwater forests are the source of sediment and water quality flowing to the sea, directly affecting seagrass and corals.

2. Restoration and Protection of Marine and Coastal Ecosystems

Krabi is facing a critical ecological turning point, especially the crisis of seagrass and coral degradation, which are both "Natural Capital" and the "Heart" of the tourism industry. Relying on state budget and mechanisms alone cannot timely handle complex challenges and Climate Change. The private sector and civil society have high potential to become "Partners" in resource management through 3 concrete cooperation models:

[3] In Thailand, this committee is officially known by the acronym JPPSCC (Joint Public and Private Sector Consultative Committee) or in Thai (Kror-Ror-Or).

- **Coral and Seagrass Restoration Projects Using Private Technology:** The opportunity here is not just traditional CSR tree planting but elevating to Market-based Mechanisms and Environmental Finance combined with measurable restoration technology.
    - **Opportunity from Blue Carbon:** Analysis of the interview with Mr. Thanawat Phukaoluan reveals an interesting concept regarding the Nature Repair Market, allowing the private sector or tourists to "buy credits" from ecosystem restoration to offset environmental impacts. This aligns with data from the Krabi Rewild forum indicating a "Nature Positive" trend and interest in "Blue Carbon" (marine resource carbon credits), which the private sector is ready to invest in if there are reliable verification and certification systems (e.g., Verra).
    - **Technology Application:** The private sector can bring technology and knowledge to aid the government where it lacks, such as surveying and monitoring seagrass/coral status and supporting research budgets. A concrete example is the "Koh Lanta Declaration," explicitly specifying "Seagrass Restoration" and "Blue Crab Bank" projects, relying on cooperation from a network of 46 organizations (state and private) to drive restoration activities based on community livelihood and economy.
    - **Ridge to Reef Linkage:** Data from the Save Krabi Hills group points to comprehensive restoration dimensions where the tourism private sector supports protecting "Headwater Forest Areas" on mountains to reduce sediment flowing into the sea covering coral and seagrass. This utilizes Area-based Management technology to systematically protect downstream ecosystems.
- **Co-management and Joint Coastal Patrolling Co-management:** Co-management is key to filling gaps in lax law enforcement and insufficient government manpower.
    - **Cooperation Model from "Koh Lanta Declaration":** The Koh Lanta Declaration document presents the most concrete co-management model, signing cooperation between the District, National Park, Local Authority, and Private Sector to define community rules like "Refraining from catching aquatic animals during spawning season" and establishing "Marine Rangers" consisting of villagers and local operators acting as eyes and ears and patrolling with state officials.
    - **Using Krabi as a Pilot Area (Regulatory Sandbox):** A major obstacle to Co-management is the centralized state power structure. From interviews, Mr. Thanawat proposes using Krabi as a legal pilot area (Regulatory Sandbox) to decentralize power to local authorities and joint state-private committees to issue regulations or manage coastal areas more agilely without waiting solely for central decisions.
    - **Source Pollution Surveillance:** Interviews with Mr. Somkiat (President of Ao Nang Tourism Business Association) reflect the private sector's role in managing wastewater and waste from the coast to prevent it from flowing into the sea, proposing PPPs in managing wastewater treatment ponds via Private Management. This is preventive coastal protection combined with local law enforcement.

- **Eco-tourism Development by Private Sector:** The private sector in Krabi is highly ready to transition to Eco-tourism and Low Carbon Tourism, acting as an income generation mechanism to sustain conservation work.
    - **Linking Community Life with Conservation:** The Koh Lanta Declaration shows success in developing community-based tourism sites like "Ban Tung Yee Peng Community Tourism Learning Center" and "Urak Lawoi Way of Life Tourism," emphasizing respect for nature and culture. The private sector acts as a marketing channel bringing quality tourists to the area, generating income that helps the community value mangrove and coastal resource preservation.
    - **Creating Value from Resources (High Value Tourism):** The private sector sees an opportunity to build the "Krabi Green Destination" brand to attract quality tourists. This appears in the Save Krabi Hills group's concept of developing cave and mountain tourism routes linked to mangroves and the sea to distribute income and reduce congestion in existing marine areas. It also includes Upcycling concepts to create souvenirs, raising tourist awareness.
    - **Business Incentive:** Interviews with Mr. Somkiat confirm that the most important incentive for the private sector is "Survival." If nature (Ao Nang/Sea) degrades, businesses cannot continue. Therefore, investing in eco-tourism is not an option but an economic necessity that the private sector is ready to invest in with the state if there are clear and continuous policies.

3. Pollution Management and Impact Reduction

Pollution management, especially waste and wastewater, is the largest "Time Bomb" threatening the sustainability of Krabi's tourism industry. Field interviews and document research show that current government infrastructure cannot handle the waste volume surging with tourism growth. Meanwhile, the private sector is ready with technology and budget but lacks legal authority and supporting infrastructure.

Therefore, the opportunity for PPPs in this dimension is not asking for charity but an urgent need for "Utility Management Structure Reform." This means shifting from inefficient state monopoly to joint management focusing on results and sustainability. Strategic opportunities can be classified into 4 main issues:

3.1 Wastewater Management Reform: From "Budget Burden" to "Public Service Business"

- ***Situation and Problem:*** Analyzing feedback from operators (Ms. Pim, Ms. May, Mr. Somkiat) reveals severe structural problems: "Failure of Central Wastewater Treatment Systems" operated by local authorities, often breaking down and smelling. Furthermore, "Flat Rate" fee policies based on room numbers create unfairness (double Investment) for hotels with high-standard treatment systems and do not incentivize water saving.
- ***Cooperation Opportunity (PPPs Opportunity):***
    - Professional Management Model: This involves changing the management of central treatment plants in economic areas (e.g., Ao Nang, Koh Phi Phi) from local officials to hiring

private experts (O&M/Private Management) or using models where the private sector invests in improvements in exchange for long-term concession rights.

- Financial Innovation and Technology: This involves adjusting fee structures to "pay as you throw" systems. The government and private sector jointly invest in installing Smart Meters to measure actual wastewater volume according to the Polluter Pays Principle (PPP). This incentivizes large hotels to invest in water recycling systems to reduce costs, creating fairness and reducing the load on central systems.

3.2 Sustainable Waste Management: Solving Logistics Problems

- ***Situation and Problem*:** Even with the success of the "Orphan Waste" project (with N15 Technology and Wongpanit), it is stuck at "Logistics Costs" in transporting waste from islands to the mainland and large garbage trucks being unable to access narrow community alleys.
- ***Cooperation Opportunity (PPPs Opportunity):***
  - **Community Transfer Stations:** This involves using Micro PPP models where the private sector (hotels/stores) supports space for sSub-waste collection points and the community manages tuk-tuks to transport waste from alleys to the collection point, waiting for large municipal trucks. This solves residual waste problems and creates jobs.
  - **Island Recycling and Orphan Waste Centers:** This involves bringin in professionals (e.g., Wongpanit) to manage. The government supports policies like subsidizing fuel for waste transport boats or offering tax benefits for cargo ships that take waste back to shore instead of running empty.

3.3. Financial Innovation for Environment: Sustainability without Relying on Central Budget.

- ***Situation and Problem:*** Delays in national budget and policy discontinuity are major obstacles. The private sector wants transparent and auditable financial systems for confidence in long-term investment.
- ***Cooperation Opportunity (PPP Opportunities):***
  - **Krabi Environmental Fund:** Establish a fund managed by a tripartite committee (State-Private-Civil Society) with income from Green Fees (collected from tourists) and Environmental Fines (from illegal operators) to solve local problems without waiting for central budget.

3.4. Comprehensive Sustainable Waste Management

- *Situation and Problem:* Plastic waste overflowing the city from both land and sea (fishing activities). Concepts of turning waste from burden to product like "Waste is not orphan" and campaigns reducing single-use plastics must continue.
- *Cooperation Opportunity (PPPs Opportunity):*
  - Upcycling: Support Social Enterprises that process marine debris into souvenirs or hotel amenities (e.g., Ocyco, Wongpanit), with the Hotel Association guaranteeing a purchase market.

- Zero Waste Event: Set standards for Krabi events to be Zero Waste like the Rewild Festival, with Nature Mind Ed as consultants.

3. Case Study of Public-Private Partnerships (PPPs)

The management of the wastewater treatment system in Ao Nang Sub-district, Krabi Province, focuses on utilizing the Public-Private Partnership (PPP) mechanism to address water pollution problems affecting the tourism industry and the quality of life of the people. This case study is synthesized from interviews with key stakeholders, including the Ao Nang Subdistrict Administrative Organization (SAO), the Provincial Office of Natural Resources and Environment, the Wastewater Management Authority (WMA), representatives of the private sector (joining with the Ao Nang Tourism Business Association and the Krabi Hotel Association), community leaders, and data from a public consultation meeting attended by representatives from almost every relevant sector, held on November 17, 2025, at Deevana Plaza Krabi Ao Nang.

3.1 Feasibility Guidelines for Public-Private Partnerships (PPPs) in Wastewater Treatment System Operations in Ao Nang Sub-district: Existing Wastewater Treatment Systems

Public-Private Partnerships are a strategic solution to address insufficient environmental infrastructure in key economic areas like Ao Nang. PPPs have the potential to attract investment, technology, and management expertise from the private sector to supplement the weaknesses in budget and operational expertise of local government agencies.

Potential and Limitations of Current Small-Scale Wastewater Treatment Systems

Surveys and interviews with stakeholders reveal that small-scale wastewater treatment systems in the Ao Nang area are diverse and face practical problems:

Large Establishments (Hotels/Resorts):

1. Potential: Most large and medium-sized hotels have their own wastewater treatment systems as required by law, and are considered to be a group with readiness and responsibility for initial management.

2. Limitations: Despite having treatment systems, high operation and maintenance (O&M) costs mean some places may not operate the systems continuously or lack efficiency in consistently meeting standards. Furthermore, legal loopholes allow small projects (under 30 rooms or area under 1,450 sq.m.) to be exempt from Environmental Impact Assessment (EIA) reports, enabling some operators to avoid investing in standard treatment systems.

Small Establishments and Shops, including Street Food:

These operators still have limitations in wastewater management and are a major problem group. Many restaurants, stalls, and markets lack wastewater treatment systems or only have inefficient grease traps. Wastewater from these activities is often discharged directly into public drains or natural water sources (creeks/canals) without treatment. Key problems include a lack of budget and space for installing treatment systems, as well as a lack of awareness, and enforcement by the government is not thorough or strict.

Household Level:

1. Potential: Communities attempt self-management in some aspects, such as the successful village waterworks grouping in Moo 2, reflecting the community's potential to manage utilities if appropriate mechanisms exist.

2. Limitations: General households often use septic tanks/cesspools. In areas with high groundwater or saturated soil, these systems do not function fully, causing wastewater to seep into groundwater or overflow.

Status and Capacity of the Krabi Wastewater Management Authority's (WMA) Wastewater Treatment System

The current status of the central wastewater treatment system in Ao Nang is in a critical state and inconsistent with the actual volume of wastewater generated due to several factors:

- **Insufficient Capacity:** The original wastewater treatment system of Ao Nang Sub-district was designed to handle approximately 600 cubic meters per day (cu.m./day) and was improved to 1,200 cu.m./day.
- **Actual Wastewater Volume:** Currently, the actual wastewater volume during the High Season reaches 3,000 – 4,500 cu.m./day and may increase to 12,000 cu.m./day in the future (next 20 years).
- **Wastewater Collection System Problems:** Although the project is in the planning and budget allocation stage, if realized, limitations will remain regarding the wastewater collection pipe network not covering the entire area, especially newly expanded areas, resulting in only some establishments connecting to the system.
- **Status of Improvement Project according to the Cooperation Agreement between WMA and SAO**: There is a plan for Phase 2 wastewater treatment system construction, but the project is delayed and has not received sufficient budget support from the central government. Additionally, the existing treatment system (Klong Chak) is dilapidated, with damaged machinery and a lack of budget for continuous maintenance and repair.
- **Update (December 2025):** The latest progress tracking in December 2025 found that the central wastewater treatment system construction project (budget over 800 million Baht) under the cooperation between Ao Nang SAO and the Wastewater Management Authority (WMA) is at the policy level. It is in the final stages of handing over the construction site opposite the stadium and signing the Memorandum of Agreement (MOA). The WMA has received a proposal from the local authority to review the cost structure so that it does not become an excessive burden on the local budget in the long term (Meeting Summary, December 18, 2025).

Legal Mechanisms and Regulations Supporting Fee Collection

Laws and regulations regarding wastewater treatment fee collection are divided into 2 levels:

1. Act Level Laws (Acts): There are two Acts:

- **Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (1992):**
  - **Section 88:** This is the main law empowering the collection of Service Fees. It mandates owners of pollution sources (e.g., hotels, establishments) or owners of buildings discharging

wastewater into the state's central wastewater treatment system to pay service fees at prescribed rates to cover system operation and maintenance costs.

- **Section 80:** This mandates owners of pollution sources to construct and install their own wastewater treatment systems or send wastewater into the central wastewater treatment system.

- **Public Health Act, B.E. 2535 (1992):** This law is used by Local Administrative Organizations (e.g., Ao Nang SAO) to supervise general sanitation, including sewage and solid waste management, which can be adapted to issue regulations regarding wastewater management and sanitation in the area.

2. Local Laws and Regulations:

- **Subdistrict Administrative Organization (SAO) Ordinances:** Ao Nang SAO has the power to issue local ordinances to set fee rates and collection criteria. However, in practice, enforcing ordinances to collect wastewater fees remains difficult due to a lack of personnel readiness and local social/political factors.

- **Environmental Protection Area Announcement:** Krabi Province has a Ministry of Natural Resources and Environment Office designating it as an Environmental Protection Area, which affects the setting of pollution discharge standards and stricter construction activity controls than general areas.

Management Mechanisms for Fee Collection

From the stakeholder meeting on wastewater treatment in Ao Nang Sub-district, all parties agreed to proceed according to the Polluter Pays Principle (PPP). This fundamental principle supports the legitimacy of fee collection, where polluters (wastewater sources) must bear the treatment costs. Currently, this is a cooperation between the Wastewater Management Authority (WMA), a state enterprise with expertise and legal authority to manage wastewater treatment systems, which is still in the process of making a Memorandum of Understanding (MOU) between the local authority (Ao Nang SAO) and WMA. If the cooperation agreement is concluded, the WMA can take over the system management and fee collection duties on behalf of the local authority, helping reduce local political limitations and increase collection efficiency.

However, there are still concerns from stakeholders regarding wastewater treatment fee collection. Although there are supporting laws, the main problem is actual enforcement in the area and setting fee rates that are appropriate and acceptable to the public and operators. Specifically, even though the law empowers the SAO to issue ordinances for fee collection, in practice, decisive enforcement is lacking due to concerns about social and local political impacts. Therefore, PPP implementation must create conditions compelling the government to use this power strictly.

3.2 Guidelines for Management and Wastewater Treatment Fee Collection under the Public-Private Partnership (PPPs) Model

Public-Private Partnerships (PPPs) are considered a key mechanism to solve the shortage of funds and management efficiency in Ao Nang's wastewater treatment system. This mechanism will help alleviate the government's budget burden and bring technology and management expertise from the private sector, with

financial sustainability through fee collection as the core. Data analysis indicates appropriate and feasible cooperation models in the Ao Nang area are as follows:

3.2.1 Appropriate Cooperation Models

Assessing the need for large-scale investment and upgrading the efficiency of the wastewater treatment system in Ao Nang, the most appropriate cooperation models are:

- **Private Management Model:** This would be a format (similar to waste power plants) where a private entity with technical expertise takes responsibility for the design, construction, and management of the entire central wastewater treatment system. The advantage is that the project can start construction faster without waiting for the entire budget from the government, helping increase efficiency and bring new technology to wastewater treatment (from 2025 interviews).

- **O&M (Operation and Maintenance) Model:** The government invests in system construction, then hires a private entity with expertise to manage system operation and maintenance with clear Key Performance Indicators (KPIs). This model helps reduce the SAO's personnel shortage problem.

3.2.2 Roles and Duties of Parties under PPPs

Partners	*Main Role*	*Support Role*
Government (Ao Nang SAO)	Power to issue regulations. Confirms readiness to issue regulations and fee collection mechanisms (e.g., local ordinances).	Regulator: Monitor and enforce environmental laws (Section 88) and penalties for non-compliance (fines or non-renewal of licenses)
Government (Wastewater Management Authority – WMA)	Technical Consultant. Can transfer management capabilities and standard wastewater treatment technology	Project Owner: Agency experienced in making MOAs with LAOs (e.g., Koh Phi Phi project) and setting conditions for binding budgets requiring local authorities to collect service fees.
Private Sector (Operators):	Investment and Management: Invest (in capital and technology) and assume responsibility for managing the wastewater treatment system to ensure efficiency in compliance with established standards. Partnership Network Expansion: Beyond the hotel sector, participation must be engaged from the Restaurant Association, Spa Association, and laundry operator groups to join as a joint working committee. This is because in-depth data indicates that these small establishments and commercial buildings account for up to 80% of the area's wastewater generation yet still lack standardized treatment systems (Meeting Summary, December 18, 2022). Guidelines for Fee Collection	Fee Payers: Must demonstrate a willingness to pay wastewater treatment fees under transparent and fair conditions, in order to preserve the beauty of the tourist destination.

3.2.3 Guidelines for Fee Collection

- **Polluter Pays Principle:** Set fee rates based on tap water consumption or actual wastewater discharge, categorized by user type (household, small business, large hotel).
- **Combined Billing:** For collection efficiency, consider combining wastewater treatment fees with water bills (PWA) or other utility bills to reduce management costs and increase payment rates.
- **Willingness to Pay:** The private sector, especially hotels and tourism businesses, shows readiness to pay fees **if the treatment system actually works**, is transparent, and can concretely solve wastewater problems, not paying while wastewater still overflows into the sea.

3.2.4 Mechanisms for Wastewater Treatment Fee Collection for Financial Sustainability

Fee collection mechanisms are the heart of financial sustainability for PPP projects:

- **Legal Enforcement:** The SAO must issue **municipal ordinances** setting reasonable wastewater treatment rates consistent with operating costs.
- **Link with Other Utilities:** Consider collecting wastewater treatment fees together with **water bills** or **electricity bills** to increase collection efficiency and reduce avoidance (currently, some tap water is managed by communities/villages, which is a potential for local-level collection).
- **Step-up Service Rates and Fair/Transparent Rates:** It is important to adhere to the principle that the private sector must be confident that fees paid will be used for serious wastewater system management and improvement (Ao Nang Tourism Business Association emphasizes this transparency). Rates should be set according to water usage (or wastewater discharge) with **clear user segmentation**, e.g.:
    - Households and Small Operators: Service rates should be low and appropriate for living.
    - Large Establishments: Higher rates according to actual pollution discharge and high-pollution activity types, with installation of standard effluent meters.
- **Legal Penalties:** The government must have clear and strict penalties for those refusing to pay fees or connect to the central wastewater treatment system (e.g., considering **non-renewal of business operation licenses** or cutting/reducing certain utility services).

3.2.5 Challenges in Collection and Enforcement

- **Avoidance Problem**: Even if LAOs issue ordinances setting fines for non-payment (e.g., quadruple fines), in practice, nothing can be done to those who don't pay, making collection discontinuous and the project unable to proceed.
- **Joint Responsibility Problem**: A major problem is that operators are not owners but tenants. Both tenants and owners should be jointly responsible for wastewater management and fees.
- **Lack of Confidence in Quality**: Some private sector stakeholders express concern that even after paying fees, water leaving the wastewater treatment plant still smells rotten, affecting confidence in joining the system.

3.2.6 Governance and Incentives

To make PPPs sustainable, governance mechanisms and incentives for partners to practice continuously must be created:

- **Joint Inspection Committee:** Establish a **Joint Establishment Inspection Committee** comprising representatives from the government (SAO/WMA) and private sector (Hotel Association) to **jointly inspect establishments**, helping supervise, campaign, publicize, and educate.
- **Enforcement and Penalties:** The government must enforce laws strictly and seriously against those discharging untreated wastewater, which is the biggest obstacle to PPPs, and must use legal measures to not renew business licenses for those refusing to pay fees.
- **Positive Incentives:** Instead of focusing solely on punishment, there should be positive measures such as Star Ratings or giving "Green Hotel" awards/certification marks to environmentally responsible establishments so tourists (especially environment-conscious Europeans) can rate and choose services, using market mechanisms to pressure hotels to join the system voluntarily.
- **Revival of the "Joint Inspection Unit":** From discussions with PONRE Krabi and the private sector on December 18, 2025, a consensus was reached to revive the "Joint Wastewater Management Monitoring Committee" mechanism to operate again under a PPP format with new guidelines:
    - Advisory & Preventive Approach: Shift focus from fault-finding to on-site visits to provide knowledge and technical advice, especially to small operators lacking knowledge on proper grease trap installation.
    - Positive Reinforcement: Besides punishing offenders, the private sector network proposed awarding prizes or "Green/Clean Stickers" to display at establishments to honor them and create marketing incentives for tourists to choose their services.
    - Inspection Frequency: Set a joint working framework of 2 times per year, during the pre-high season (October-November) and post-high season (April-May), to align with the workload of operators and officials.

3.3 Recommendations: Operational Recommendations and Appropriate Wastewater Treatment Management Models for the Local Context to Promote Public-Private Partnerships (PPPs) in Krabi Province

To drive concrete action, operational measures consistent with Ao Nang's context are needed. In the stakeholder meeting on November 17, 2025, recommendations were made on two main issues:

3.3.1 Appropriate Management Model:

Propose a "Management and Maintenance Concession" model where Ao Nang SAO (Area Owner) joins with WMA (Technical Consultant) to contract with a private entity:

- **Private Entity:** Responsible for improving the existing system to full efficiency and investing in expanding the system in urgently needed parts, as well as managing the pipe system and pumping stations.

• **Government (SAO):** Issue controlling ordinances and collect fees, hand over management rights to the private entity, and act as a regulator.

3.3.2 Operational Actions:

• Zoning and Decentralized Systems: Since Ao Nang has steep terrain and scattered communities, using a single centralized system may not be cost-effective. Consider installing Small Community Wastewater Treatment Systems (Cluster Systems) in risk points like Klong Chak or canal-side communities, with the private sector installing and maintaining them.

• Grease Management from Restaurants: The SAO should enforce laws requiring every shop and restaurant to install grease traps/small treatment tanks. There should be regular inspections and the establishment of a "Grease Collection Service Unit" (could be a community enterprise or private entity) to collect and dispose of grease properly, charging a per-time service fee to reduce the burden on public drains.

• Community Participation: Apply the successful model of "Village Waterworks" (Moo 2) by allowing the community to participate in inspecting or managing small-scale wastewater treatment systems in their area to create a Sense of Ownership.

• Joint Public-Private Committee: Establish a Tripartite Committee (SAO, Private/Tourism Association, People's Sector) to verify project transparency, treatment system operation, and fee spending to build confidence for payers.

3.3.3 Financial Sustainability for Inspection Mechanism:

To ensure the wastewater inspection mechanism continues uninterrupted when external funding (e.g., TDRI) ends, the province should include this project in the Annual Provincial Budget Plan (Tier 1 or Tier 2). Plan in advance to request a budget for the fiscal year 2029 or use the province's central budget to drive it during the transition period to ensure continuity of law enforcement and education.

4. Policy Recommendations and Conclusion

4.1 Policy Recommendations to Promote Public-Private Partnerships (PPPs)

The transition of Krabi Province from a volume-focused world-class tourist destination to a model city of "Regenerative Tourism" under the "Krabi Go Green" vision cannot be achieved through siloed working models or reliance solely on government authority and budget. Amidst environmental crisis challenges and complex problems, it is crucial to reform the management structure to create a "Policy Ecosystem" conducive to joint investment, effort, and shared responsibility among the Government, Private Sector, and Civil Society.

This document proposes reforms through 4 main areas and specific proposals for strategic areas to unlock existing limitations and create sustainable new mechanisms, as follows:

Recommendations on Legal and Regulatory Structure: Establishing an "Environmental Innovation Sandbox"

Currently, the rigidity of bureaucratic regulations has become a major obstacle hindering cooperation, especially the Public Procurement and Supplies Administration Act, which does not facilitate special hiring formats. For

example, hiring the private sector to transport waste by boat from islands to the mainland incurs higher costs than on land. Additionally, the centralization of decision-making authority regarding forest and national park land use at the central level causes delays in solving local problems and fails to keep up with crisis situations.

1. Declare Krabi a "Special Innovation Area for Sustainable Environmental Management" (Krabi Sustainable Environment Sandbox): The government should push for a national cabinet resolution or issue specific ministerial regulations to grant Krabi the status of a pilot area that can experiment with management models more flexible than normal regulations, focusing on 2 urgent issues:

- **Procurement Regulation Reform:** Unlock Local Administrative Organizations (LAOs) to hire the private sector, community enterprises, or long-tail boat groups for comprehensive waste and wastewater management (including cross-island transport). Alternatively, allow setting median prices that reflect actual costs in the island context so the private sector can operate without loss and ensure continuity.
- **Reducing Steps for Public Use Land Requests:** Streamline steps and decentralize authority for permitting the use of forest or national park land for projects where the private sector invests for conservation and restoration without conflicts of interest. Examples include placing mooring buoys to protect coral, creating nature study trails, or building waste transfer stations. Authority should be delegated to a "Provincial Level Committee" for one-stop approval.

2. Decentralization towards Joint Area Management: Accelerate the amendment of regulations of the Department of National Parks, Wildlife and Plant Conservation, the Department of Marine and Coastal Resources, and the Royal Forest Department to officially support the legal status of Area Committees. This committee must have a proportion of representatives from the community and private sector as members with voting rights, not just advisors. This will allow them to determine Community Rules themselves, such as setting opening-closing times for tourist sites, limiting tourist numbers (carrying capacity), or defining special conservation zones appropriate to the season and local context.

4.2 Recommendations on Institutional Mechanisms: Creating Sustainable "Participatory Governance"

Policy discontinuity caused by the transfer of high-level officials, lack of trust between the state and private sector, and redundant work of agencies under various affiliations make the private sector hesitant to invest in long-term projects.

1. Establish the "Krabi Sustainability Council": Upgrade the existing temporary working group into an organization with permanent status (potentially established as a City Development Foundation or a specific legal entity) to act as the province's "Environmental PPPs Regulator." Its structure and authority should be:

- **Composition:** Must adhere to the Tripartite principle in equal proportions among: 1. Government (Governor/PONRE/LAOs), 2. Private Sector (Hotel Association/Chamber of Commerce/Tourism Industry Council), and 3. Civil Society (Save Krabi Hills Group/Sea Gypsies Network/Various foundations working in Krabi and academics).

- **Authority and Duties:** Responsible for defining long-term development strategies (10-20 years) that will not change with the Governor's term; authority to consider and approve PPP project principles; and authority to audit the transparency of Environmental Fund budget spending.

2. Create a "Middleman" Mechanism: Support local educational institutions or NGOs accepted by all parties to act as a "Middleman" in coordination, helping mediate conflicts, and "translating" bureaucratic language into business and community language to reduce communication gaps and help agreement negotiations happen fairly.

3. Upgrade the "Joint Operation Unit": Propose adjusting the structure of the existing wastewater quality inspection working group to have a composition that is more comprehensive and reflective of local realities. This involves expanding the private sector network to cover not just the Hotel Association but also the Restaurant Association, Spa Business Association, and Laundry Operator Group, which are groups with high proportions of wastewater discharge in urban communities. Additionally, a new role should be defined as an "Advisory & Preventive Unit" focusing on field visits to provide technical advice and give opportunities for improvement before law enforcement (Warn before Enforce). The joint operation frequency should be set at least twice per year (pre- and post-tourism season) to ensure continuity without creating an excessive burden on operators.

4.3 Recommendations on Financial and Fiscal Tools: Turning "Burden" into "Power"

1. Establish the "Krabi Natural Resources and Environment Rehabilitation Fund" (Krabi Green Fund): Create financial independence for the province by reducing reliance on the central budget through fundraising from new revenue sources:

- **Tourism Fees:** Collected from foreign tourists, clearly specifying the objective for environmental conservation, with legal backing to ensure this money is reserved for use in Krabi area 100% (without sending it to the central treasury).
- **Fines from Offenders:** Integrate fines from arrests for illegal wastewater discharge or dumping to be sent directly to this fund for impact remediation.

2. Reform Incentive Structures:

- **Reform Wastewater Fee System:** Change from a flat-rate per room system to a "Pay based on actual discharge" system by installing wastewater meters and providing “Rebates” for hotels with standard wastewater treatment systems to incentivize technology investment.
- **Logistics Subsidy Measures:** Use money from the Green Fund to subsidize the difference in waste transport costs from islands to the mainland for private transport boats so that the recycling market mechanism can actually work in remote areas.

4.4 Recommendations on Data and Technology: Decision Making Based on Fact

1. Develop a Central Environmental Data Platform: Push for joint investment between the state and private sector to build a Big Data database linking data from 3 main sources.

- Satellite Imagery: Monitoring forest encroachment and coastal erosion (GISTDA).
- Ground-based: Data from sensors measuring real-time water and air quality[4].
- People's Sector: Reports of rare marine animal sightings or whistleblowing on illegal dumping via applications, strengthening coastal citizen data forwarding.

2. Use Data for Law Enforcement and Rewards: Use platform data to "Target" offenders for precise arrest operations (reducing official discretion) and to "Certify" Green Hotel performance for considering awards or tax benefits fairly.

4.5 Specific Area Recommendations: Application in Strategic Areas (e.g., Areas under Dolomite Mining Projects)

1. Up Watershed Forest Areas: Transition from Conflict Zones to Eco-Tourism Sites

- **Removing Areas from the Mineral Master Plan:** This is the most critical Prerequisite The government must have clear Zoning policies, separating headwater forests and archaeological sites from potential mineral areas to reduce investment risks for the private sector and communities.
- **Upgrading the Committee:** Upgrade the existing fact-finding committee to a "Sustainable Krabi Mountain Area Management Committee" (Tripartite) with decision-making power on the joint area development direction.
- **Storytelling & Value Creation:** The private sector uses marketing expertise to create stories making Krabi's forests and caves a global destination for ECO geological tourism to attract international investment support.

2. Urban and Coastal Areas (Ao Nang/Phi Phi): Pollution Management Sandbox

To solve pollution problems (wastewater/waste) sustainably, it is necessary to push Ao Nang as an "Urban Environmental Management Sandbox" with specific measures:

- **Improving Local Regulations:** Ao Nang SAO must urgently draft and announce New Wastewater Management Ordinances setting fee rates reflecting actual costs and having clear, severe penalties.
- **Supporting Binding Budgets:** The provincial and central governments should allocate multi-year binding budgets for infrastructure investment to build confidence for the private sector to join PPP investments.
- **Strict Environmental Law Enforcement:** PONRE and related agencies must enforce laws on establishments equally without discrimination, especially inspecting effluent quality at the source to pressure operators to join the central treatment system.

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[4] Install floating buoys in water bodies. These buoys monitor pH or Dissolved Oxygen (DO) levels 24 hours a day and immediately transmit data to officials' mobile phones if water quality deteriorates, eliminating the need to deploy boats for daily manual water sampling.

- **Establish Special Organization:** Consider establishing a Special Form Agency (similar to Pattaya or BMA but focused specifically on environmental missions) with powers to manage revenue and budget agilely to solve wastewater and waste problems specifically in key economic areas.
- **Reduce Agency Redundancy:** Designate a Single Host Agency with absolute authority in environmental law enforcement and a regular self-audit system.

4.6 Recommendations on Project Sustainability: "Supporting Binding Budgets" or Creating Financial Sustainability for Inspection Mechanisms

To prevent budget interruptions as in the past, Krabi Province should include the wastewater quality surveillance inspection plan in the Provincial Annual Budget Plan (Tier 1) or prepare it as a Reserve Project (Tier 2) at least 1-2 fiscal years in advance. It should be planned to link with the province's central budget during transition periods to ensure that PPP mechanisms for environmental surveillance can continue continuously and effectively.

4.7 Conclusion

Amidst the global trend towards sustainability, Krabi Province faces a critical turning point in upgrading from a volume-focused world-class tourist city to a model of **"Regenerative Tourism"** under the **"Krabi Go Green"** vision. However, rapid growth in the tourism industry, combined with the climate change crisis, has resulted in natural resource degradation, including residual waste problems, wastewater, and ecosystem damage from headwater forests to coral reefs.

Reliance solely on government mechanisms can no longer handle this complex challenge. This report aims to study and assess opportunities for establishing Public-Private Partnerships (PPPs) to mobilize power, technology, and innovation to protect and restore ecosystems holistically from "Ridge to Reef." Stakeholder Analysis results show that the key to driving PPPs in Krabi depends on the dynamics of 3 main sectors:

- **Government:** Government is in transition from "Regulator" to "Facilitator" but faces structural obstacles: bureaucratic rigidity, policy discontinuity from executive transfers, and delayed budget constraints.
- **Private Sector:** Tourism businesses are especially alert and have high potential for environmental investment, realizing that "Nature is a Business Cost." However, they are concerned about unfair law enforcement between legal and illegal operators. Initiations have been made to expand cooperation networks to high-risk business groups like Restaurant Associations, Spa Associations, and Laundry Operators to cover wastewater sources thoroughly.
- **Civil Society and Community:** These stakeholders are strong and desiring to upgrade status from aid recipients to "Co-managers" with rights to manage and care for local resources together.

Assessment of PPP Opportunities from data synthesis identifies high-potential opportunities in 3 main dimensions:

- **Up watershed Forest Conservation (Ridge):** Propose transforming conflict areas from mining concessions in 4 districts into new economic zones through **"Eco-Geological Tourism,"** with the private sector investing in green infrastructure and management systems alongside communities acting as forest guardians.

- **Marine Ecosystem Restoration (Reef):** Focus on using modern financial mechanisms like "Nature Repair Market" and Blue Carbon Credits. The private sector can buy credits from seagrass and coral restoration to offset environmental impacts, coupled with developing Co-management patrol systems to protect conservation areas.
- **Pollution Management:** Considered the most urgent agenda. Proposals include **"**Utility Management Reform" shifting from inefficient state operation to Private Outsourcing (O&M) for central wastewater treatment, and solving cross-island waste logistics problems via boat transport subsidies. This is coupled with reviving the "Joint Inspection Unit" mechanism focusing on Advisory & Preventive measures and creating Positive Incentives like awarding "Water Guardian Establishment Symbols" to stimulate voluntary compliance.

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Appendix 1

Stakeholder Interview Summary

The interviews were conducted with various key stakeholders to gather comprehensive insights into the environmental and wastewater management issues in Ao Nang. The stakeholders are categorized into four main groups:

1. Central Government Agencies
    - Manager of Wastewater Management Authority (WMA), Krabi Branch
    - Krabi Provincial Office of Natural Resources and Environment (MNRE Krabi)
    - Deputy District Chief of Mueang Krabi District (Responsible for Ao Nang Subdistrict)
2. Local Government (Ao Nang Subdistrict Administrative Organization - SAO)
    - Chief Executive of the Subdistrict Administrative Organization and Deputy Chief Executive of the Ao Nang SAO
    - Environmental Officers of Ao Nang SAO
    - Sub-district Headman (Kamnan) of Ao Nang
    - Village Headmen (Moo 2 and Moo 3)
3. Private Sector (Hotels & Associations)
    - Resort Owners in Ao Nang
    - President of Ao Nang Tourism Business Association
    - President of Krabi Hotel Association
4. Civil Society & Community

The details are as follows:

1. Central Government Agencies

1.1 Wastewater Management Authority (WMA), Krabi

Interview Date: **September 25, 2025**

Interviewee: **Mr. Amornchai Hiranrat (Manager)**

- WMA collaborates with Ao Nang SAO through an MOU for wastewater treatment. A single MOU covers the local administrative organization; thus, the second treatment plant opposite the Sailboat Monument requires an MOA instead of a new MOU.
- For budget requests, WMA applies directly to the Bureau of the Budget. However, project readiness documents must be prepared and submitted by the SAO. Currently, WMA is waiting for SAO documents to

construct an onshore treatment plant. The estimated budget is expected to exceed 300 million THB, requiring a detailed cost estimation before submission.

- Pumping stations will be utilized to transfer wastewater to an underground treatment plant. The wastewater collection system is crucial; higher collection volume leads to higher treatment capacity. WMA uses a Reverse Osmosis (RO) system. Treated water is reusable, monitored by the Pollution Control Department, and is already being reused at the Phi Phi Island office.

1.2 Krabi Provincial Office of Natural Resources and Environment (MNRE)

Interview Date: **September 25, 2025**

Interviewee: **Mr. Surachai Kunthong (Director of Environment Division)**

- The organizational structure of central government agencies places a heavy burden on a minimal workforce, which is insufficient compared to the escalating and complex problems in the province. MNRE acts as the secretariat for the operational working group solving wastewater and solid waste issues in Krabi.
- MNRE operates under the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (amended B.E. 2561) and Ministry declarations designating environmental protection zones in various districts including Ao Nang.
- There is a strong proposal to elevate Ao Nang into a Special Economic Zone. This would allow for more agile management, necessary because Ao Nang has grown exponentially and attracts a highly diverse population (various religions, nationalities, languages, etc.).

1.3 Deputy District Chief of Mueang Krabi District

Interview Date: **October 22, 2025**

- Wastewater has been a critical crisis in Ao Nang since 2011-2012. Financial constraints play a significant role, as installing adequate treatment machinery requires substantial budget and land space.
- Actual local stakeholders are few in numbers. Large hotel operators generally comply with regulations and have dedicated teams managing wastewater systems. The primary problem stems from small operators leasing spaces for food stalls. These tenants lack true ownership and consequently lack proper management systems.
- The District Office does not issue direct regulations but integrates efforts with various sectors to inspect, enforce, and publicize rules. Different agencies enforce different acts (e.g., SAO uses the Public Health Act, Town Planning uses the Building Control Act, MNRE uses the Environmental Act). National Park laws remain the strictest.

2. Local Government & Community Leaders

2.1 Chief Executive of the Subdistrict Administrative and Deputy Chief Executive of Ao Nang SAO

Interview Date: **September 15, 2025**

Interviewees: **Mr. Phankham Kittithonkun (Chief Executive of the Subdistrict Administrative Organization) and Mr. Itsara Ngampradit (Deputy Chief Executive of the SAO)**

- A treatment plant exists on Phi Phi Island managed by WMA, with SAO contributing per the MOU. Practically, the budget has ballooned due to the high costs associated with island operations. The SAO received two treatment machines from the Environmental Office, but the actual wastewater volume exceeds their capacity.
- The SAO utilizes the Public Health Act to collect wastewater and waste management fees. However, the law does not grant SAO the authority to enforce severe penalties. Collecting fees from properties managed by the SAO is quite difficult.
- The revenue generated from waste and wastewater collection fees is vastly insufficient to cover the costs. The SAO must divert revenue from other sources to manage these environmental issues.

2.2 Ao Nang SAO Officials (Public Health & Environment Division)

Interview Dates: **October 22, 2025 (and some information from the Sept 15th interview)**

Interviewees: **Mr. Apisit Suknui (Environmental Officer), Mr. Itsara (Deputy Chief Executive of the SAO), Ms. Miguel (Officer)**

Core Challenges & Legal Constraints:

- It is extremely difficult to reach business operators because many are external investors who do not register or apply for permits locally. A massive number of small businesses evade environmental control laws, collectively contributing heavily to untreated wastewater.
- SAO relies on the Public Health Act and Environmental Control Acts, but SAO officials are not legally designated as 'Competent Officials' under some key environmental laws. This prevents SAO from directly arresting or prosecuting offenders. SAO can only educate, warn, or withhold permit renewals.
- Fee collection is hindered by legal limitations regarding local government revenue generation. Budgets allocated are insufficient for the rapid growth of Ao Nang.
- SAO proposes creating incentives, such as awarding 'Michelin Star'-style environmental stickers to compliant businesses to encourage tourist support. A revolving fund for small businesses to borrow for treatment system installation was also suggested.

View of the Capacity of Treatment Systems (Mr. Apisit Suknui)

Currently, Ao Nang SAO's treatment capacity is grossly insufficient. Existing systems can handle about 1,200 cubic meters per day (600 cu.m. per point). However, the actual wastewater generated is approximately 3,000 - 4,000 cubic meters per day.

Issues Categorized by Source:

- Large Establishments/Hotels: While they have standard systems, continuous maintenance is an issue. Skilled technicians are often poached or resign. Reporting is poor; less than 5% of hotels report their wastewater treatment results to MNRE as required by law.
- Restaurants & Small Businesses: Most operators are tenants, not landowners (owners often reside in Phuket), leading to a lack of shared responsibility. Grease traps are often household-sized, completely inadequate for commercial volume. Space constraints prevent proper installations.

- Laundry Shops: A frequently overlooked major issue. Coin-operated machines and laundries use standard septic tanks designed for human waste, which cannot treat chemical detergents. Untreated chemical wastewater flows directly into nature.
- Households: Releasing wastewater into seepage pits on private land is not illegal if not discharged into public spaces, but practically, pathogens seep through the soil into the sea (e.g., fecal bacteria found in Railay and Phi Phi waters).

Specific Problem Areas and SAO Needs

- Khlong Chak (Chak Canal): The canal mouth is lower than sea level, causing sand blockage, water stagnation, and sediment accumulation. The water is often black from sedimentation and seawater mixing, not just wastewater. Dredging and future WMA collaborations are planned.
- Khlong Ying Suea (Ying Suea Canal): Primarily receives household wastewater with no communal treatment system. SAO conceptually plans to install a small cluster-based electromagnetic treatment system, but faces space and electrical constraints.

Support Required by Ao Nang SAO (Collaboration with TDRI):

- Knowledge & Tech: Requires academic data and 'small, high-tech, and affordable' wastewater technology recommendations for operators.
- Research: Requested TDRI to study wastewater management mechanisms for laundry shops and find best practices.
- Social Measures: Proposed 'Green Hotel' or Star Ratings to utilize market mechanisms (tourist pressure) instead of relying solely on state power.

2.3 Sub-district and Village Headmen (Sub-district Headman (Kamnan) of Ao Nang)

Interview Date: **September 25, 2025**

- Public-private cooperation is relatively strong regarding solid waste management; very little litter is seen in public areas. However, wastewater is harder to manage, especially from street food vendors discharging directly into drains. The transient population is estimated at 50,000 and growing.
- Requests national-level prioritization, granting more authority and budget to local governments commensurate with the high revenue Ao Nang generates for the country.

2.4 Village Headman Moo 3 (Mr. Boonserm Butkhaek)

Interview Date: **October 25, 2025**

Ao Nang grew abruptly. Previously, canals were crystal clear. The treatment machine at the end of Khlong Ying Suea is insufficient as it receives wastewater from villages, big hotels, and restaurants. Emphasized the need for strict law enforcement and community mobilization.

2.5 Village Headman Moo 2 (Mr. Somboon Changruea)

Interview Date: **October 10, 2025**

Warned of a massive influx of small, non-compliant businesses (hostels, guesthouses) in the next 2-10 years. Also detailed the Long-tail Boat Club (138 members) which strictly enforces a 'no ocean dumping' rule for its members.

3. Private Sector (Hotels & Associations)

3.1 Ms. Pim, Owner of Na Sook Wellness Resort

Interview Date: **November 6, 2025** (Online interview)

- Impacts of Environmental Degradation: Businesses suffer directly when nature degrades (e.g., dead corals, unsafe swimming water) leading to fewer tourists. On Phi Phi Island, the central treatment plant's output still smells foul.
- Policy Conflicts & Unfair Fees: Large hotels with excellent self-treatment systems are forced to connect to the central system to renew licenses, wasting reusable treated water. Furthermore, treatment fees are charged per room rather than actual water volume, penalizing efficient hotels.
- Desired PPP Investment Models: Proposed tangible incentives such as 'Green Tax' benefits, fee reductions for compliant hotels, and prioritizing international standards like GSTC (Global Sustainable Tourism Council) to reduce redundant paperwork.
- Active Participation: Her resort utilizes 100% recycled treated water for organic farming, operates mangrove/seagrass nurseries, and acts as a key organizer for the 'Krabi Rewild Initiative'.

- PPP Risks: Highlighted weak law enforcement against illegal operators which creates unfair cost advantages, and inconsistent policies that destroy the incentive to operate 'Green Hotels'.

3.2 President of Ao Nang Tourism Business Association (Mr. Somkiat Khayankarn)

Interview Date: **September 15, 2025**

- Currently, most wastewater is discharged directly into nature. Grease traps are insufficient and failing. Large businesses face space constraints for holding tanks. A central treatment system is absolutely essential.
- The association is ready to collaborate with the government and promote environmental care among its members. Urged the government to include private sector representatives in planning committees, as private businesses possess advanced vision and practical experience in water treatment.

3.3 President of Krabi Hotel Association (Ms. Wichupan Phukaoluan)

Interview Date: **November 7, 2025**

- Image Conflicts: The province's 'Krabi Go Green' image is contradicted by state actions like limestone quarrying. 'Good' hotels face high costs to maintain standards, while illegal operators undercut prices with zero environmental costs.
- Investment Needs: Requested subsidies for SMEs to achieve GSTC standards, fee reductions for green hotels, and increased fees for non-compliant ones (stepped rates). Requested TAT to provide commercial privileges to green hotels.
- Orphan Waste Project: A self-sustained initiative by the association where hotels separate difficult 'orphan waste' (like plastic films wrap) and send it to Wongpanit (a recycling company) to be used as fuel in cement plants, drastically reducing landfill waste.
- Main PPP Risks: The biggest obstacle is the lack of strict law enforcement against bad actors, causing a loss of faith in the system ('Why do good when the bad get rich?').

4. Civil Society and Community

4.1 Imam of Khlong Haeng Mosque (Mr. Somchai Wajidi)

Interview Date: **November 7, 2025**

- The mosque possesses a strong structural committee (15 members) that collaborates seamlessly with the village committee, the Muslim Women's group, health volunteers, and the SAO.
- Highlighted the severe solid waste problem in Ao Nang (65-70 tons per day). The main issues are improper disposal times/locations and the lack of source separation by the community, which leads to contaminated waste that is extremely difficult to recycle or manage.

4.2 Imam of Ao Nang Al-Munawwarah Mosque (Mr. Somdet Khayankarn)

Interview Date: **November 7, 2025**

- The mosque acts as a strong community hub. In Village Moo 2, they have established a localized management system, hiring their own street sweepers and managing waste separation with excellent public cooperation.
- Advocated for managing wastewater at the source by instilling awareness and educating operators first. Over-reliance on strict legal enforcement often leads to evasion. The mosque committee and villagers are fully prepared to cooperate in protecting Ao Nang's natural resources.

Appendix 2

Summary of the Meeting on Ao Nang Wastewater (November 17, 2025)

Date: November 17, 2025 Location: Deevana Plaza Krabi Aonang Hotel

Participants: 34 people from the government sectors (Provincial Office of Natural Resources and Environment, Ao Nang Sub-district (Tumbon) Administration Office, Wastewater Management Authority), private sector (Krabi Hotel Association,) Ao Nang Tourism Business (Long tail boat Club, Side car Clubs and Taxi Club), and civil society (Imam, Village Headmen).

A critical milestone in this project was the multi-stakeholder meeting organized to address the wastewater crisis in Ao Nang. The meeting aimed to build consensus on collaborative solutions under a PPP framework.

Key Issues Found

- Infrastructure Deficit: The current wastewater collection piping network does not cover the entire district. Many small businesses and street food vendors lack proper grease traps or treatment systems, discharging directly into public drains.
- Regulatory Gaps: There is a lack of enforcement targeting non-compliant businesses. Furthermore, small hotels (under 30 rooms) often evade Environmental Impact Assessment (EIA) requirements, leading to substandard wastewater management.
- Budgetary Constraints: Local authorities (Ao Nang TAO) lack the personnel and technical knowledge to effectively monitor all establishments or invest in necessary infrastructure upgrades.

What Everyone Agreed On

- Private Businesses: They are willing to pay fees to treat wastewater. However, they want honesty. The system must actually work (clean the water), and the rules must apply to everyone (not just big hotels) so it is fair.
- Community: Local leaders want strict rules targeting businesses that use "fake" treatment systems just to pass inspections.
- Government: Agencies proposed the "Polluter Pays Principle." This means if you use water, you pay a fee. This money will invest in necessary infrastructure upgrades

The Solutions

The meeting agreed on four ways to work together (PPP):

1. Joint Inspection Team: A team with members from the government, businesses, and the community will inspect shops together. This creates transparency.

2. Private Management: Hire a private company to run and fix the treatment plant. They can do it more efficiently using the fee money.

3. Rewards: Use a "Star" system or "Green Hotel" award. Good businesses get rewarded because tourists prefer eco-friendly places.

4. Cluster Systems: In areas where big pipes can't reach, allow private investment in smaller, local treatment systems.

Recommendations

To make these ideas happen, the report recommends:

1. Pass New Laws: The Ao Nang local government must pass laws to collect wastewater fees. It is best to add this fee to the water bill so people understand the reason for the charge, and can pay it easily.

2. Create an "Ao Nang Sandbox": Make Ao Nang a special zone. This allows flexible rules so private companies can easily help manage waste.

3. Strict Grease Trap Rules: Force all restaurants to install grease traps. A private service can be hired to collect the grease regularly.

4. Community Helpers: Officially allow community groups to help monitor the environment. This helps the government officers who are short-staffed.

Conclusion

This meeting reflects the shared intent of all sectors to restore the Ao Nang ecosystem through a 'Partnership' mechanism between the government, private sector, and civil society. The key proposal is the revival of the Joint Committee to conduct field inspections, educate, and build awareness, coupled with the use of incentives and the establishment of a support fund for small operators rather than relying solely on law enforcement.

Sustainable success will only occur when all parties 'start counting from one together,' with sincere and continuous government support to preserve Krabi's invaluable 'natural capital' forever.

Summary of Workshop Brainstorming Highlights

1. Main Issues Affecting Wastewater Management

Issue	Main Commentator	Details
1. Growth & Management	Secretary of Tourism Assoc., WMA	Rapid tourism growth outpaces the government's capacity to manage it, and financial problems persist.
2. Small Enterprises	VP of Tourism Assoc., Hotels	There is a massive number of small enterprises. Most lack wastewater treatment systems, knowledge, and awareness.
3. Government Limitations	MNRE Krabi, Ao Nang SAO	Lack of central budget allocation since the COVID pandemic. The SAO lacks sufficient manpower/officers and suffers from inadequate communication.
4. Transparency & Facilitation	Mosque Imam	Government agencies should not set unreasonably high fees. Officials should only collect legally mandated fees without imposing extra charges.
5. Monitoring & Supervision	Restaurant Operators	Inspections of wastewater treatment at restaurants are neither serious nor continuous.

2. Summary of Opinions & Recommendations on Wastewater Treatment Fees

Patong Model (Tiered Fees): The VP of the Tourism Association proposed separating fee rates based on fairness. Operators with good treatment systems should pay less (only a discharge or inspection fee) to avoid redundancy. Those without treatment systems must pay the full fee, potentially collected as a tax.

Budget Management & Awareness: MNRE Krabi agreed that the root problem is the lack of central budget, which prevents operational teams from conducting thorough inspections. Furthermore, relying solely on law enforcement is insufficient; building the awareness of business operators is essential for sustainable solutions.

Polluter Pays Principle: WMA explained that fees are necessary for operational costs (electricity, chemicals, personnel). Fees are calculated based on tap water usage (approx. 80% becomes wastewater) and categorized by user type. WMA acknowledges collection is difficult and requires municipal regulations and incentives (e.g., discounts for standard self-treatment).

Warn Before Arrest Strategy: Hotel representatives suggested that the government should explain and warn operators before enforcing strict laws, particularly targeting small restaurants lacking grease traps rather than

strictly regulated large hotels. They suggested the government initiate a support fund to encourage private and community cooperation.

SAO Operational Limits & Incentives: The Ao Nang SAO admitted to having insufficient staff and difficulty reaching actual business owners. They proposed positive incentives, like a 'Star Rating' for good wastewater management, a fund to help small shops install systems, and a 'mixed inspection team' from multiple sectors to overcome the manpower shortage.

3. Recommendations for Problem Solving and Cooperation

The recommendations focus on creating sincere cooperation mechanisms and incentives.

Proposed Solution	**Stakeholder Recommendation**
1. Cooperation Mechanism (Joint Committee)	VP of Assoc. proposed a Joint Inspection Committee. Sec. of Assoc. emphasized the government must be the main host. The Imam noted performance tracking is needed.
2. Campaign & Education	The Joint Committee must campaign, publicize, and educate operators to build awareness for systematic management (VP of Assoc.).
3. Incentives (Reward)	Create incentives and provide rewards to operators who strictly follow conditions and exhibit excellent management (VP of Assoc.).
4. Treated Water Utilization	Consider utilizing the water that has already passed through the agency's wastewater treatment system (Mosque Imam).
5. SME Model	SAO should accelerate the development of wastewater management models for small and medium enterprises as a practical guideline.
6. Law Enforcement	Restaurant operators demand that wastewater treatment inspections at shops be taken seriously and conducted continuously.
7. Sincerity & Collaboration	MNRE Krabi and WMA emphasized the government's sincere intention, requesting cooperation from all sectors to 'start counting from 1 together'.

Appendix 3

Cooperation of hotel establishments in Ao Nang Subdistrict, Krabi Province

1. A workshop on wastewater management and related laws for hotels, restaurants, and laundromats in Ao Nang Subdistrict, Mueang Krabi District, Krabi Province. (May 25, 2026)

Krabi Province, in collaboration with the Thailand Development Research Institute (TDRI) Foundation and the Office of Natural Resources and Environmental Policy and Planning (ONEP), organized a workshop on wastewater management and relevant laws for hotel establishments, restaurants, and laundry service providers. The objective of the workshop was to enhance knowledge, understanding, and promote proper practices in accordance with relevant technical standards and legal requirements among operators.

The workshop was held on 25 May 2026 at Deevana Plaza Krabi Aonang Hotel, with a total of 60 participants. Resource persons included experts from the Krabi Provincial Public Health Office, who provided training on wastewater management and relevant legislation for restaurants and laundry businesses, and experts from Regional Environmental Office 15, who delivered training on wastewater management and relevant legal frameworks for hotel establishments.

2. Inspection and provision of guidance to hotel establishments in Moo 2, Ao Nang Subdistrict, Mueang Krabi District, Krabi Province.

Task Force for Addressing Wastewater and Solid Waste Issues in Krabi Province

Krabi Province has established a Task Force for addressing wastewater and solid waste issues in the province under Order No. 1046/2569, issued on 24 February 2569 (2026). The Task Force is composed of the Deputy Governor of Krabi Province (as assigned) as Chairperson; the Deputy Director of the Internal Security Operations Command, Krabi Province (ISOC Krabi) or representative; the Permanent Secretary of Krabi Province or representative; and the Commander of Krabi Provincial Police or representative as Vice-Chairpersons. Heads of relevant government agencies, or their representatives as designated in the order, serve as Task Force members. The Director of the Krabi Provincial Office of Natural Resources and Environment serves as both a member and Secretary.

The Task Force is mandated to supervise, oversee, monitor, and inspect wastewater and solid waste issues arising from all types of establishments; provide guidance and enforce relevant laws in accordance with the authority of each responsible agency; and facilitate integrated responses to complaints and grievances. It is also responsible for developing short-, medium-, and long-term action plans, as well as reporting progress and outcomes to the Governor of Krabi Province.

The 1st Meeting of the Task Force for Addressing Wastewater and Solid Waste Issues in Krabi Province (No. 1/2569) was held on Tuesday, 19 May 2026. The meeting was convened to prepare and plan the field inspection activities of the Task Force, including site visits to provide guidance on environmental management and

wastewater treatment for hotel establishments located in Village No. 2, Ao Nang Subdistrict, Mueang Krabi District, Krabi Province. The field inspection is scheduled to take place during 8–9 June 2026.

The meeting was attended by representatives from relevant agencies, including the Krabi Provincial Office of Natural Resources and Environment (Krabi Provincial ONEP), the Thailand Development Research Institute (TDRI), Ao Nang Subdistrict Administrative Organization (Ao Nang SAO), Hat Noppharat Thara–Mu Ko Phi Phi National Park, Regional Environmental Office 15 (REO 15), Krabi Provincial Public Health Office, Krabi Provincial Local Government Office, and the Krabi Hotel Association.

Summary of Key Findings from the Inspection of Hotel Establishments in Ao Nang Subdistrict, Mueang Krabi District, Krabi Province (8–9 June 2026)

1. Key Issues, Constraints, and Outstanding Challenges

The inspection of hotel establishments identified several significant issues and operational constraints, as follows:

- **Wastewater Quality Management:** Effluent quality analyses revealed that wastewater discharged from certain establishments exceeded the prescribed standards, particularly with respect to Biochemical Oxygen Demand (BOD), Total Kjeldahl Nitrogen (TKN), and Sulfide levels. In addition, deficiencies in system maintenance were observed, including excessive accumulation of grease in grease traps and inadequate sludge and grease removal practices.
- **Regulatory Compliance and Licensing:** Several establishments were found to be operating with expired hotel operating licenses and health-hazard activity permits, while others were in the process of

renewing such permits. Certain businesses operating within hotel premises, such as restaurants and beverage outlets, had not yet obtained the required licenses.

- **Environmental Documentation and Reporting:** Many establishments lacked adequate knowledge of, or documentation relating to, environmental assessment requirements, including Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports. Furthermore, numerous hotels had not registered or submitted wastewater treatment system performance reports pursuant to Section 80 (Forms TS.1 and TS.2). In several cases, wastewater quality monitoring records were unavailable or did not cover all legally required parameters.
- **Personnel and Capacity:** A common issue identified across most establishments was the absence of an officially appointed wastewater treatment system operator, as required under the Ministerial Regulation B.E. 2567 (2024). In addition, responsible personnel were often unavailable during inspections, limiting the provision of technical information.
- **Infrastructure and Facilities:** Several wastewater treatment facilities and related infrastructure were found to be damaged or non-compliant with technical standards, including broken manhole covers, uncovered treatment tanks, and grease traps that were improperly designed or incapable of effectively separating oil and grease from wastewater.

2. Overall Strengths and Weaknesses of the Inspected Hotels

Strengths

- Most hotel representatives demonstrated a positive attitude and cooperated fully with inspection teams, while also being receptive to recommendations and technical guidance.
- Many establishments employed soakaway-based wastewater management systems without direct discharge into external water bodies, thereby reducing potential impacts on public waterways.
- Some establishments had implemented wastewater reuse and recycling practices, achieving full reuse of treated wastewater for purposes such as landscape irrigation and fishpond replenishment.

Weaknesses

- Environmental awareness and understanding of regulatory requirements among operators remained limited.
- Misconceptions regarding wastewater treatment practices were observed, particularly the indiscriminate addition of Effective Microorganisms (EM), which may disrupt biological treatment processes and reduce treatment efficiency.
- In several cases, hotel operators functioned as tenants rather than owners and therefore lacked direct responsibility for wastewater systems or knowledge of system layouts.
- Environmental records and documentation were often incomplete and poorly organized.
- Preventive maintenance and routine monitoring of wastewater quality were insufficient, resulting in suboptimal system performance.

3. Recommended Areas for Improvement and Public–Private Partnership (PPP) Mechanisms

Actions Recommended for the Private Sector (Hotel Operators)

- Expedite the appointment of qualified wastewater treatment system operators in compliance with applicable legal requirements.
- Improve and rehabilitate wastewater treatment facilities and grease traps to ensure proper functionality and compliance with technical standards.
- Ensure timely preparation and submission of all required environmental reports, including Section 80 reports (Forms TS.1 and TS.2), EIA-related documentation, and wastewater quality monitoring records.
- Obtain, renew, and maintain all relevant operational licenses and permits in accordance with applicable regulations.

Actions Recommended for Government Agencies

- Enhance technical support and advisory services for operators, including the development of practical guidance materials and ongoing consultation mechanisms.
- Organize training programmes to strengthen the capacity of wastewater treatment system operators.
- Increase awareness-raising efforts regarding environmental regulations and promote integrated coordination among relevant agencies, including local administrative organizations, provincial

environmental offices, and public health authorities, to reduce duplication and improve regulatory efficiency.

Public–Private Partnership (PPP) Approach

- Strengthen collaboration among hotel operators, local administrative organizations, and environmental authorities to ensure effective and sustainable wastewater management.
- Adopt a facilitative and advisory approach rather than a purely enforcement-based approach, emphasizing continuous technical assistance, regulatory guidance, and support for compliance.
- Encourage the private sector to proactively implement recommended improvements to wastewater management infrastructure, contributing to the shared objective of protecting environmental quality and safeguarding community well-being.

Annex

List of Hotel Establishments (Group 1) in Village No. 2, Ao Nang Subdistrict, Mueang Krabi District, Krabi Province, Inspected on 8–9 June 2026

1. Bluesotel SMART Krabi
2. Centara Ao Nang Beach Resort & Spa Krabi
3. Golden Beach Resort
4. Sea Seeker Krabi Resort
5. Hotel Adam Krabi Ao Nang
6. COSI Krabi Ao Nang Beach Hotel
7. Ao Nang Paradise Resort
8. Bluesotel Krabi Ao Nang
9. Ava Sea Resort
10. Ao Nang Village Resort
11. The Verandah Hotel
12. Peace Laguna Resort & Spa
13. Krabi Heritage Hotel
14. Vacation Village Phra Nang Inn Krabi
15. Panan Krabi Resort
16. Ao Nang Villa Resort
17. The Dream Garden Ao Nang

List of Hotel Establishments (Group 2) in Village No. 2, Ao Nang Subdistrict, Mueang Krabi District, Krabi Province, Inspected on 8–9 June 2026

1. Aonang Dugong
2. Latisa Hotel Aonang
3. J Hotel
4. Sabai Hotel Aonang
5. The BRC Aonang Hotel & Resort
6. Avani Ao Nang Cliff Krabi Resort
7. Holiday Inn Resort Krabi Ao Nang Beach
8. Aonang Place Hotel
9. Krabi Tipa Resort
10. Wake Up Aonang Hotel
11. P.S. Hill Hotel Aonang
12. iRest Ao Nang Seafront
13. Aonang Princeville Villa Resort and Spa
14. The L Resort
15. Aonang Sunset Hotel

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