



# Regional Flyway Initiative · Site Study

January 2026

## **RFI Priority Site · Pak Nam Prasae**

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## General Site Information

Country	Thailand		
RFI Site Name	Pak Nam Prasae	ID129	
City/ Municipality, Province, Region	Pak Nam Prasae subdistrict, Klaeng district, Rayong Province. Marginally in Chantaburi Province.		
Geographical coordinates	12.70° N, 101.71° E	Area (has)	10,783 ha
Key species	Spotted Greenshank		
Key habitats (biomes)	Mangrove forests and intertidal mudflats		
Key ecosystem services	Provisioning services (fisheries), regulating services and cultural services.		
Key drivers of change	Coastal erosion and invasive species		
Conservation status (mark all that applies)	<input type="checkbox"/> Protected Area	<input type="checkbox"/>	<input type="checkbox"/> Flyway Network Site
	<input type="checkbox"/> Ramsar Site	<input type="checkbox"/>	<input type="checkbox"/> Others _____
IBA/ KBA name (and number) and other designations	N/A		
Management Stakeholders	Klaeng district government, Pak Nam Prasae TAO, DMCR, Department of Fisheries, Department of Water Resources		
With management plan?			
Project concept themes	Wetland management and restoration, aquaculture and fisheries		
Length of project	5-6 years		
Sector/s	Aquaculture and fisheries		
No. of potential beneficiaries	An estimated 4,700 people live within the site.		
Indigenous Peoples	<input type="checkbox"/> No	<input type="checkbox"/>	<input type="checkbox"/> Yes _____
Anticipated Implementation Risks	None anticipated, but livelihoods of fishers may be impacted in the short term.		
Estimated Project Budget (US\$)	9,350,000		
Potential Source/s of Financing	<input type="checkbox"/> Loan (to be identified)	<input type="checkbox"/>	<input type="checkbox"/> Private Sector
	<input type="checkbox"/> Grant (to be identified)	<input type="checkbox"/>	<input type="checkbox"/> Public-Private Partnership

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## Acronyms

ADB	Asian Development Bank
AWC	Asian Waterbird Census
BCST	Bird Conservation Society of Thailand
CSR	Conservation Status Review
DOF	Department of Fisheries
DMC	Developing Member Country
DWNP	Department of Wildlife, National Parks and Plant Resources
DWR	Department of Water Resources
EAAFP	East Asian-Australasian Flyway Partnership
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
MNRE	Ministry of Natural Resources and Environment (Thailand)
NHA	Non-hunting Area
NGO	Non-governmental Organisation
ONEP	Office of Natural Resources and Environmental Policy
RID	Royal Irrigation Department
RFI	Regional Flyway Initiative
TAO	<i>Tambon</i> Administrative Organisation
TESSA	Toolkit for Ecosystem Services Assessment
USD	United States Dollars

## Executive summary

The Pak Nam Prasae (10,000 ha) coastline spans the eastern Gulf of Thailand and is located along the Prasae River estuary in Rayong Province. Pak Nam Prasae comprises an extensive area of mangrove forests, intertidal mudflats, creeks, and inshore waters around the district (*amphoe*) of Klaeng, while to the west it is bounded by fishponds and cultivation. The Prasae estuary was recently identified by the Bird Conservation Society of Thailand (BCST) as among the three most important wintering sites for the Endangered Spotted Greenshank in Thailand, with congregations exceeding 5% of the world population each season. The site further supports eight waterbird species that are globally Near Threatened or globally threatened. At present, there are no management framework in place for Pak Nam Prasae although it is clear that the Department of Marine and Coastal Resources plays a major role over the jurisdiction of the coastal zone while mangrove forests at the site fall within the Pa Prasae-Phang Rat National Forest Reserve under the jurisdiction of the Royal Forest Department. The abutting fishponds are mostly under private ownership. Consultations led by the BCST and ONEP have also identified the site as an important wetland at the national level, and a local conservation group consisting of key stakeholders has been recently established.

Pak Nam Prasae's coastal ecosystems offer important provisioning services through its coastal (fish) and crab fisheries, which benefit communities living along the Rayong and Chantaburi coastline, alongside key regulating services in the form of coastal protection. Over time, mangrove forest cover has declined gradually due to conversion to other land uses, particularly aquaculture expansion. Interventions to improve the management of Pak Nam Prasae are expected to involve the development of a site-based management plan to address threats and disturbance through participatory approaches. There are also opportunities for targeted restoration of degraded and harvested mangrove forests along Prasae River coast and disused fishponds to the west of the estuary. Given the importance of the fishing and aquaculture industry to the local population, there is an opportunity to promote and strengthen sustainable production processes for crab and shrimp aquaculture, small-scale fisheries (for mackerel), and shellfisheries along the coast. This may include a co-management system for small-scale artisanal fisheries (to strengthen value chains).

# 1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortium of international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site selection analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water-based ecosystem services and stored carbon.

In Thailand, a total of 36 wetland sites, including several Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which 18 were short-listed for assessment. Of this pool of sites, twelve (12) were defined and identified to be RFI priority sites on the basis that they support over 1% the flyway population of at least one EAAF migratory waterbird species. Nine (9) of the RFI sites identified are coastal wetlands, a consequence of the country's long coastline along the Gulf of Thailand and Peninsular Thailand, with the largest cluster of priority sites concentrated in the Inner Gulf of Thailand (four: Pak Thale-Laem Pak Bia, Khok Kham, Bang Pu, Khlong Tamru). Three inland (freshwater) wetlands are distributed in Nakhon Sawan and Buri Ram provinces, identified for their important to species such as Baer's Pochard (CR) and Sarus Crane (VU). 15 EAAF species exceeded the 1%

threshold at the site level in Thailand, with species such as the Spotted Greenshank (EN) exceeding 10% of the estimated population in just one site (Laem Pak Bia) on a regular basis. Other species with important non-breeding populations in Thailand includes Spoon-billed Sandpiper (CR), Great Knot (EN), and Sarus Crane.

## 2. Site profile of Pak Nam Prasae

*Location:* Pak Nam Prasae is a coastal wetland on the Gulf of Thailand, located in eastern Thailand about 200 km to the south-east of Bangkok. Pak Nam Prasae is a *tambon* (sub-district) of Klaeng District, Rayong Province.

*Area:* The Pak Nam Prasae RFI site covers an area of 10,783 ha.

*Altitude:* Sea level (<2 m)

*Geographical coordinates:* 12.70° N, 101.71° E

*Description of site:* Pak Nam Prasae is a coastal wetland located at the mouth of the Prasae River, which originates from the mountains in Chanthaburi Province. The site lies on a coastal plain that supports some of the largest areas of mangrove forests in the eastern Gulf of Thailand, as are extensive intertidal mudflats along the coast. The site is criss-crossed by numerous creeks and canals. Remote sensing data showed that the site supported (10,060.86, rai, or approximately 1,609 ha) of mangrove forests (Intacharoen & Maliwan 2019)

*Site administration, management and land tenure:* The wetlands at Pak Nam Prasae do not fall within a protected area under Thai legislation. Jurisdiction over the coastal zone of Pak Nam Prasae, including areas under mangrove forest cover and intertidal flats is held by the Department of Marine and Coastal Resources (DMCR) and the Royal Forest Department (RFD) respectively. For instance, about 1,600 ha of mangroves fall within the Pa Prasae-Phang Rat National Forest Reserve (Pokila & Pattaratuma 2007), which is managed by the RFD. The majority of fishponds (to the west of the site) are under private ownership. There is an ongoing project led by the Bird Conservation Society of Thailand (BCST), in collaboration with ONEP and DMCR, to strengthen local capacity for wetland and shorebird conservation at the site, and local community networks have been recently established, with support from the *tambon* government.

*Social and economic values:* Pak Nam Prasae supports a busy fishing port. An estimated 4,700 people live within the site. About half of the people who live along the coast are directly involved with fishing and aquaculture (e.g. sea fishing, shrimp farming, crab aquaculture) and brackish-water fish farming. Agriculture is also important and there are plantations of mangoes and coconuts. Tourism is another important source of income for the local people, who have developed homestay accommodation that

popular with domestic tourists. The tourists hire fishing boats for trips along the river and visit a nature trail through the mangrove forest.

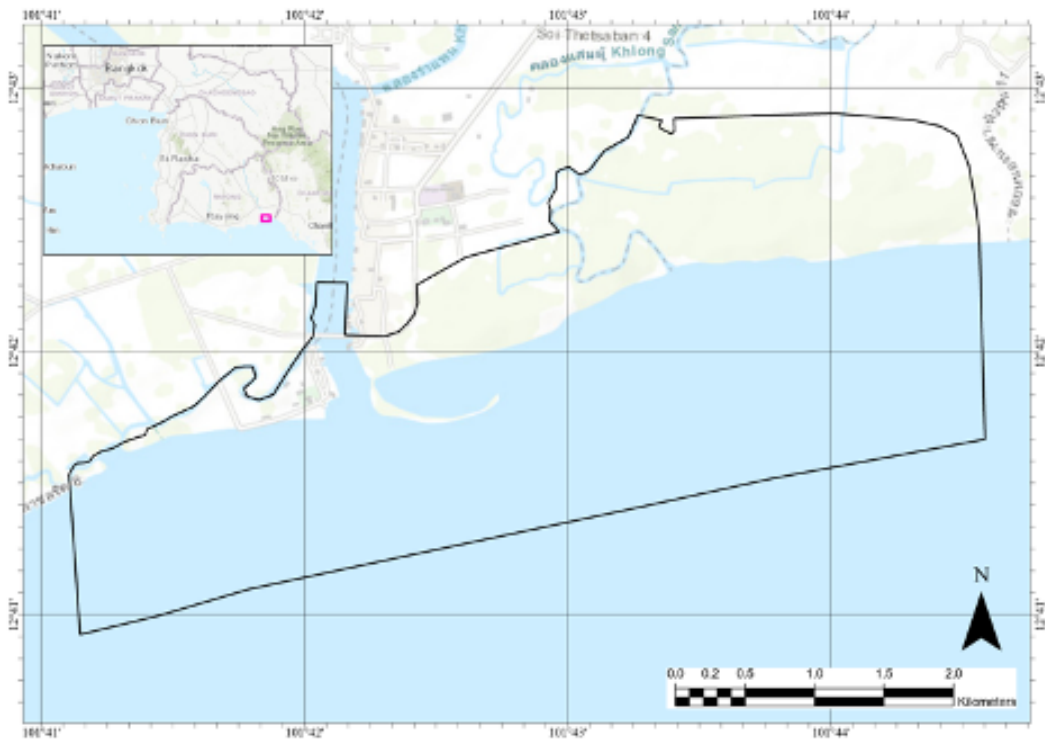


Figure 1. Map of Pak Nam Prasae, showing its boundary (in black) and location within Thailand (in pink) (data from EAAFP Site Information Sheet).

### 3. Biodiversity value of Pak Nam Prasae

#### 3.1. Key habitats

Pak Nam Prasae is a coastal wetland at the mouth of the Prasae River, which originates in the mountains of Chanthaburi Province. The site includes extensive mangrove forests, intertidal mudflats, creeks, and inshore waters around the district (*amphoe*) of Klaeng, while to the west it is bounded by fishponds and cultivation.

#### 3.2. Importance of Pak Nam Prasae for migratory waterbird species

Count data from the 2017 and 2018 Asian Waterbird Census (AWC) and the Thailand Shorebird Survey (2021-2022), supplemented by data on Spotted Greenshank from Zöckler et al. (2018), was averaged in the RFI analysis for Pak Nam Prasae, and then compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. The two species in Table x were found to regularly exceed the 1% population estimate during these three years, and the CSR1 score for these species were summed to provide the overall site score. Pak Nam Prasae was also found to support significant numbers of the near-threatened Curlew Sandpiper *Calidris ferruginea*.

**Table 1. List of migratory species (based on the EAAFP list of species) with globally significant congregations in Pak Nam Prasae.**

Scientific name	IUCN	Average count	CSR1	CSR1 score
Spotted Greenshank <i>Tringa guttifer</i>	EN	50	10	5.0
Lesser Sandplover <i>Charadrius mongolus</i>	LC	316	300	1.1

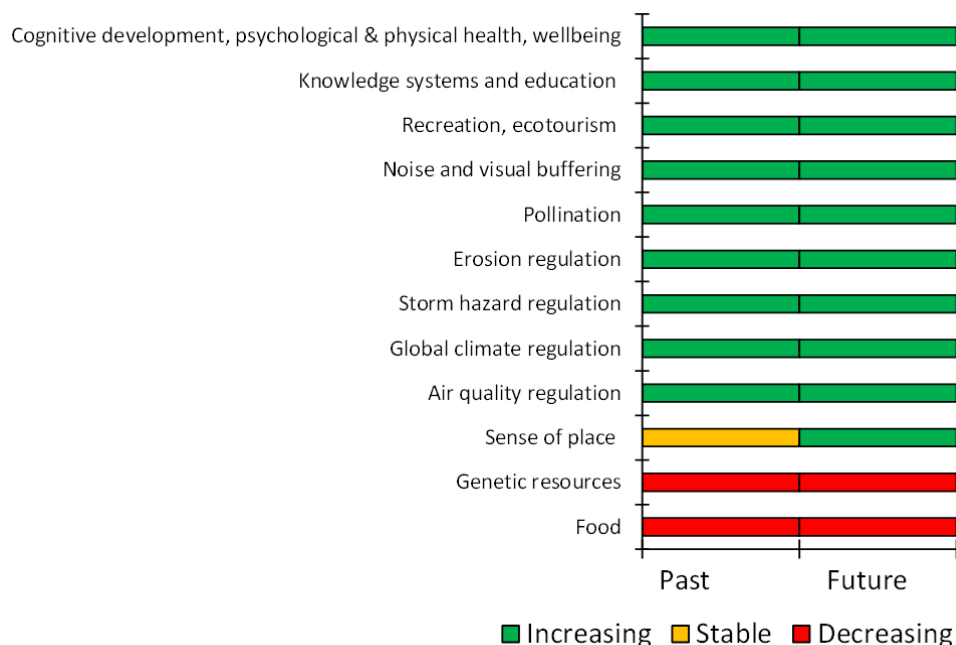
#### 3.3. Other notable biodiversity

The globally threatened Lyle's Flying Fox *Pteropus lylei* (VU) is reported to occur at this site, with boat trips organised for tourists to view this species and fireflies.

## 4. Ecosystem services

### 4.1. Ecosystem services provided by Pak Nam Prasae

Pak Nam Prasae overlaps with diverse coastal habitats, providing valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop<sup>1</sup> highlight the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, such as food and ornamental resources, primarily benefit adjacent communities. Food provision has increased in the past and is projected to remain stable in the future. Ornamental resources have also seen an increase, but a decrease is expected in the future, indicating concerns for sustainable use. Regulating services, particularly global climate regulation, benefit adjacent communities. This service has remained unchanged in the past but is expected to increase in the future, highlighting its growing role in climate mitigation. Cultural services, including cultural identity and heritage and aesthetic experience, are significant for adjacent communities. Cultural identity and heritage have experienced an increase in the past but are projected to decrease in the future. In contrast, aesthetic experience has remained stable and is expected to continue without change, reinforcing the area’s cultural significance.



**Figure 2. List of ecosystem services provided by Pak Nam Prasae, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.**

<sup>1</sup> Asian Development Bank. (2023, November 27-29). Thailand: Wetland Ecosystem Services Workshop [Workshop]. Thailand. <https://events.development.asia/learning-events/thailand-wetland-ecosystem-services-workshop>

*Table 2. List of top ecosystem services provided by Pak Nam Prasae.*

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
<i>Provision services</i>						
Food		✓			Increase	No change
Ornamental resources		✓			Increase	Decrease
<i>Regulating services</i>						
Global climate regulation		✓			No change	Increase
<i>Cultural services</i>						
Cultural identity and heritage		✓			Increase	Decrease
Aesthetic experience		✓			No change	No change

#### 4.2. Global climate regulating services

Based on systematic reviews (Chen & Lee, 2022; Stankovic et al., 2023), the amount of carbon stored in Pak Nam Prasae is estimated to range from 14,700 to 32,800 tonnes, while the annual carbon sequestration rate is estimated to be between 222 and 517 tonnes per year.

#### 4.3. Coastal protection services

The coastal protection services provided by Pak Nam Prasae were assessed using both biophysical indices and monetary values (see Tables A1 and A2, and Annex 1 for details). When compared to both the average of the nine RFI coastal sites and the average of all other coastal areas in Thailand (Table A3 in Annex 1), Pak Nam Prasae shows some mixed results in terms of risk level:

(1) for the potential exposure to coastal hazards, Pak Nam Prasae is consistently below average (index: 2.63 vs. 2.75 for RFI coastal sites and 2.70 for all other coastal areas);

(2) for the contribution to reducing coastal risk as a proportion of population density with 2.5 km of the coast, Pak Nam Prasae is below average compared to RFI coastal sites (53 vs. 63 people/ha) but above average compared to all other coastal areas (53 vs. 30 people/ha); and

(3) for the contribution to reducing coastal risk as a percentage of the maximum potential exposure, Pak Nam Prasae is consistently above below average (5.94% vs. 5.44% for RFI coastal sites and 3.92% all other coastal areas).

In monetary terms (Table A4 in Annex 1), Pak Nam Prasae ranks well below the national RFI average (300 vs. 1,987 USD/ha) in terms of total annual benefits per ha of mangroves. Consequently, these benefits for the total area of Pak Nam Prasae are also below average (0.6 vs. 1.8 million USD for RFI coastal sites and 0.8 million USD for all other coastal areas in Thailand).

## **5. Drivers of change and their potential impacts on Pak Nam Prasae**

### **5.1. Current drivers of change and their level of impact**

Stakeholders at the RFI workshop<sup>2</sup> identified several drivers of change impacting Pak Nam Prasae. Table 3 highlights these key drivers of change and their corresponding levels of impact on the wetland site. High-impact drivers include invasive animal species, which pose significant threats to the native biodiversity and disrupt the ecological balance of the wetland.

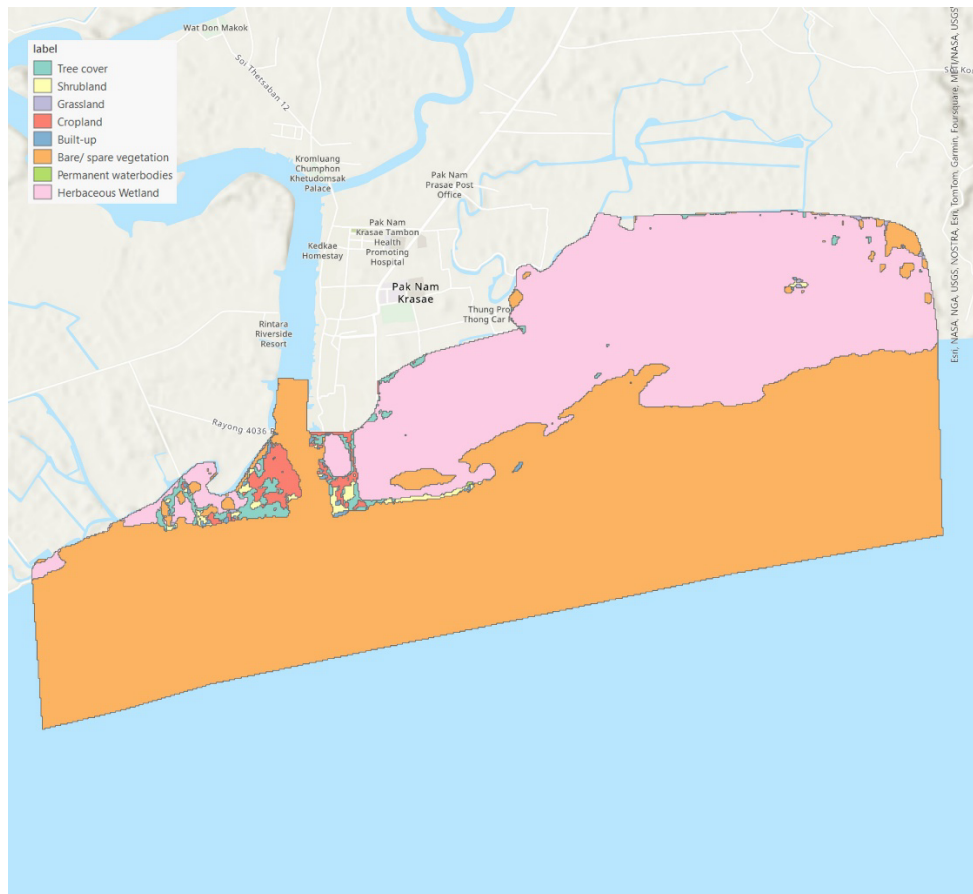
Medium-impact drivers involve erosion and siltation, which affect habitat stability and water quality. Other medium-impact factors include fishing, killing, and harvesting of aquatic resources; garbage and solid waste accumulation; household sewage and urban wastewater; invasive plant species; and marine and freshwater aquaculture. Recreational activities, tourism, research and educational activities, restoration for conservation, sewage from wetland facilities, and tourism infrastructure also contribute to the moderate impact on the site's ecological health.

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<sup>2</sup> Asian Development Bank. (2023, November 27-29). Thailand: Wetland Ecosystem Services Workshop [Workshop]. Thailand. <https://events.development.asia/learning-events/thailand-wetland-ecosystem-services-workshop>

**Table 3. Drivers of change and their potential impact on the integrity of Pak Nam Prasae based on consultations with stakeholders.**

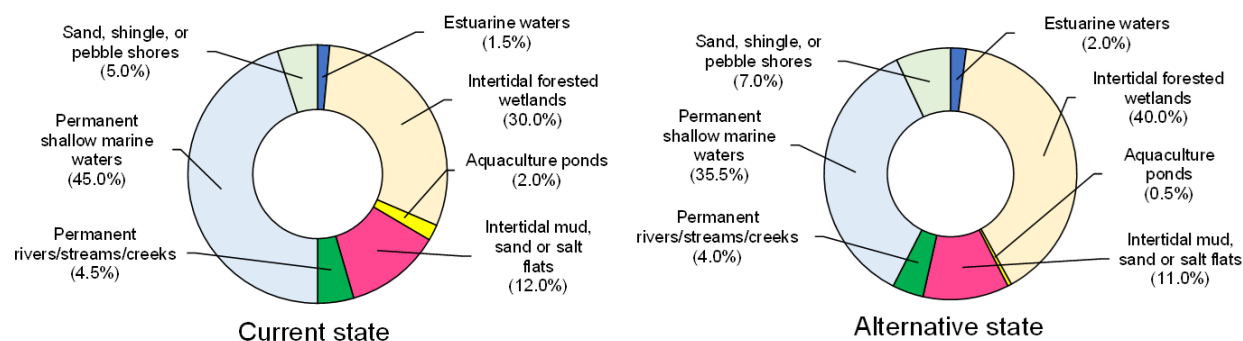
Driver of change	Impact
Invasive animal species	High
Erosion and siltation/deposition	Medium
Air-borne pollutants	Low
Fishing, killing and harvesting of aquatic resources	
Garbage and solid waste	
Household sewage and urban wastewater from outside the wetland site	
Invasive plant species	
Marine and freshwater aquaculture	
Recreational activities and tourism	
Research, education and other work-related activities	
Restoration for conservation	
Sewage and wastewater from wetland site facilities	
Tourism and recreation infrastructure	



**Figure 3. Land cover types in the Pak Nam Prasae coast (Map: Radhika Bhargava)**

## 5.2. Potential alternative state of Pak Nam Prasae under current drivers of change

Stakeholders at the RFI workshop<sup>3</sup> defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site (current habitat cover vs future alternative cover; Figure 4). The alternative state of the site assumes there will be no changes in the current drivers of change impacting the site, and the current management regime.



**Figure 4. The proportional change in the extent of different habitat types between the current and alternative states of Pak Nam Prasae.**

## 5.3. Expected changes in the ecosystem services of Pak Nam Prasae

Stakeholders at the RFI workshop<sup>4</sup> documented the future trends in the provision of ecosystem services in Pak Nam Prasae, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable if the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Figure 2 and Table 2 highlight that provisioning services, particularly food provision, are expected to increase in the long term. However, there is concern that regulating services, such as air quality and global climate regulation, as well as flood and storm hazard regulations may decrease in the long term, while cultural services, particularly recreation and tourism, remain stable.

<sup>3</sup> Asian Development Bank. (2023, November 27-29). Thailand: Wetland Ecosystem Services Workshop [Workshop]. Thailand. <https://events.development.asia/learning-events/thailand-wetland-ecosystem-services-workshop>

<sup>4</sup> Asian Development Bank. (2023, November 27-29). Thailand: Wetland Ecosystem Services Workshop [Workshop]. Thailand. <https://events.development.asia/learning-events/thailand-wetland-ecosystem-services-workshop>

Pak Nam Prasae overlaps with diverse coastal habitats, providing valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop<sup>5</sup> highlights the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, such as food and ornamental resources, primarily benefit adjacent communities. Food provision has increased in the past and is projected to remain stable in the future. Ornamental resources have also seen an increase, but a decrease is expected in the future, indicating concerns for sustainable use. Regulating services, particularly global climate regulation, benefit adjacent communities. This service has remained unchanged in the past but is expected to increase in the future, highlighting its growing role in climate mitigation. Cultural services, including cultural identity and heritage and aesthetic experience, are significant for adjacent communities. Cultural identity and heritage have experienced an increase in the past but are projected to decrease in the future. In contrast, aesthetic experience has remained stable and is expected to continue without change, reinforcing the area's cultural significance.

In the alternative state, the 75% loss of mangrove and 8% loss of intertidal mudflat will result in a loss of stored carbon, estimated to be between 2,300 and 10,100 tonnes, and a decrease in carbon sequestration rate by approximately 35 and 256 tonnes per year.

A loss of 19.0 ha of mangroves as presented in Table A5, which is equivalent to 1.5% of the total land use for the site, is expected to result in roughly a 1% reduction in coastal protection. This may amount to nearly six thousand USD in lost total benefits per year (based on 300 USD per hectare of mangroves) and 15 thousand USD in lost total benefits per 100-year return period storm.

## 6. Capacity needs in Pak Nam Prasae

Pak Nam Prasae is only recently identified as an important site for migratory species and while it currently lacks formal designation and recognition there are plans to recognise the site as an EAAFP Flyway Network Site. There are ongoing projects led by BCST and supported by BirdLife on the ground to engage and consult local government agencies, including the TAO subdistrict government and the fishing community to raise awareness of the wetlands and its value to local stakeholders, and coordinated with ONEP. Like Khlong Yai (in Trat), the fishing and aquaculture are the largest source of livelihoods for coastal communities in Pak Nam Prasae. Capacity interventions should aim to improve local stakeholders' knowledge of the site, and also advance sustainable and environmentally friendly fishing practices, while promoting livelihood development for both local and migrant workers.

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<sup>5</sup> Asian Development Bank. (2023, November 27-29). Thailand: Wetland Ecosystem Services Workshop [Workshop]. Thailand. <https://events.development.asia/learning-events/thailand-wetland-ecosystem-services-workshop>

## 7. Opportunities for RFI interventions

### 7.1. Recommended Interventions

Pak Nam Prasae currently lacks formal protection and jurisdiction of the coastal wetland environment here lies largely with the DMCR and RFD, while fishponds are under mostly private ownership. The sites mangrove forests have declined gradually due to conversion to other forms of land uses, especially aquaculture expansion (Intacharoen & Maliwan 2019) The wetland sites have significant biodiversity value and have been recognised by well government agencies. Next steps to improve the management of the site could involve the development of a, (1) site-based management plan for to address threats and disturbance and define the roles of stakeholders involved in its management and the site, and targeted actions to build the resilience of local communities to climate change. There are also opportunities for targeted restoration of degraded and harvested mangrove forests along Prasae River coast and disused fishponds to the west of the estuary (current mangrove cover – 2,900 acres); mangrove forests are actively being harvested by local communities under leases with the government.

Given the importance of the fishing and aquaculture industry to the local population, there is an opportunity to promote and strengthen sustainable production processes for crab and shrimp aquaculture, small-scale fisheries (for mackerel) and shellfisheries along the coast. This may include a co-management system for small-scale artisanal fisheries (to strengthen value chains).

*Table 4. Summary of key RFI interventions proposed for Pak Nam Prasae (Krasae)*

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1. Improve site-level management and targeted wetland habitat restoration</i>					
Undertake environmental and social impact assessments of proposed project activities	Best practices, guidelines, and standards for proposed RFI interventions	<p>Environmental and social impact assessment report finalised and disseminated with key local stakeholders.</p> <p>Guidelines for evaluating proposed project components on their positive and negative impacts developed.</p> <p>Guidelines and standards for an iterative process on redesigning project components developed and implemented.</p>	100,000	Up to 1.5 years.	<p>DMCR</p> <p>DWR</p> <p>Klaeng district government</p> <p>Pak Nam Prasae <i>tambon</i> government</p> <p>Consultancy companies</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		<p>Number of consultations conducted with local stakeholders for a participatory process in developing standard and guidelines for project interventions</p> <p>Number of stakeholder groups engaged in the assessment and development of project interventions' guidelines</p>			
Conduct hydrological and climate change impact assessment.	Priority and vulnerable coastline areas restoration and management in Pak Nam Prasae identified.	<p>Hydrological and climate change impact assessment report finalised, presented to local stakeholders and endorsed by designated management authority.</p> <p>Area for habitat restoration and resilience building identified.</p> <p>Number of consultations conducted with local stakeholders for a participatory process in the local assessment.</p> <p>Number of stakeholder groups engaged in the assessment.</p>	100,000	Up to 1.5 years.	
Restore degraded mangrove forests and habitat along the Pak Nam Prasae coast to improve climate resilience.	Improved wetland management and protection through mangrove restoration and other suitable nature-based solutions on the Rayong coastline.	<p>Priority and target areas for restoration identified, with species matching.</p> <p>Area (target of up to 50 ha) of degraded coastal habitat restored with suitable mangrove species</p> <p>Area (target of at least xx km) with coastal protection using natural</p>	200,000	5 years	<p>DMCR</p> <p>Khlong Yai (town) government</p> <p>Khlong Yai tambon government</p> <p>Research institutions</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	Degraded areas of mangroves on the Prasae estuary, and disused fishponds restored.	materials established and supported.  Number of stakeholder groups engaged in the mangrove restoration and coastal protection activities.			
Establish a community-led site management organization/framework and committee, with relevant government mandates.	Improved wetland management through the co-management with local communities	Co-management framework developed, in consultation with key stakeholders and endorsed by relevant management authorities  Number of agreements established for a coordinated management approach for the site among relevant stakeholders  Number of consultations conducted with stakeholders for a participatory process.  Number of stakeholder groups engaged in the development of the co-management framework.  A multi-stakeholder management committee established, with regular meetings.	100,000	1.5 years	DMCR  ONEP  Klaeng district government  Pak Nam Prasae TAO  Conservation organisations (including BCST, BirdLife)  EAAFP
Establish an OECM for Pak Nam Prasae, including a medium to long term site management plan.	Improved wetland management and climate resilience of Pak Nam Prasae through site management planning	Wetland management plan addressing threats, disturbance, climate resilience, and site conditions developed and endorsed by key government agencies and local stakeholders.	100,000	5 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Strengthen international recognition of Pak Nam Prasae as a wetland for migratory waterbirds.		<p>Number of consultations conducted with key stakeholders for a participatory process.</p> <p>Number of stakeholder groups engaged in the wetland management planning</p> <p>Number of activities in the site management implemented</p> <p>Number of local and/or international designation (ex. Pak Nam Prasae recognised as a Flyway Network Site) facilitated.</p>			
Strengthen site mitigation against the impacts of climate change.	Improved wetland management and climate resilience of Pak Nam Prasae through resilience strategy development.	<p>Assessment report about the local climatic conditions developed and presented to local stakeholders.</p> <p>Resilience strategy developed, based on the assessment report, presented to key stakeholders and endorsed by relevant management authorities.</p> <p>Number of consultations conducted with key stakeholders for a participatory process.</p> <p>Number of stakeholder groups engaged in the resilience strategy development.</p> <p>Number of activities in the resilience strategy implemented</p>	100,000	1 year	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Establish a long-term community led biodiversity monitoring programme.	Improved biodiversity conservation through monitoring and increased participation of local communities in protecting migratory waterbird species	<p>A biodiversity monitoring framework focusing on key species indicators (e.g. Spotted Greenshank) established and implemented.</p> <p>Indicator species identified and actively monitored.</p> <p>A capacity program on the developed biodiversity monitoring framework created for key stakeholders</p> <p>Number of people trained on biodiversity monitoring.</p> <p>A multi-sector biodiversity monitoring group organized.</p> <p>Number of biodiversity monitoring activities implemented.</p>	50,000	3 years	<p>ONEP</p> <p>Conservation organisations (including BCST, BirdLife)</p>
Improve the understanding of the ecology of Spotted Greenshank usage of Pak Nam Prasae.	Improved biodiversity conservation of indicator species through increased knowledge and documentation about species movement and dispersal patterns	<p>Research reports and peer-reviewed papers (target of at least one new research project established to understand Spotted Greenshank movement ecology and habitat needs) published.</p> <p>Number of people engaged in the local species studies.</p>	50,000	2 years	<p>DWNP</p> <p>Conservation organisations</p> <p>Research institutions</p>
<i>Component 2. Strengthening local livelihoods for small-scales fishers and aquaculture operators</i>					
Develop a co-management system for small-scale artisanal	Improved management of Pak Nam Prasae through	A co-management framework and plan for small-scale fishers finalized and approved by Department of	500,000	5 years	<p>Fishery cooperatives</p> <p>Department of Fisheries</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<p>fisheries (to strengthen value chains), as a contribution to sustainable fisheries and coastal management program for Thailand.</p> <p>Improve livelihood and income-generating activities for local communities with a focus on small-scale fisheries (for mackerel).</p>	<p>improved local livelihood, shifting to sustainable fishing practices and support for local community cooperatives.</p> <p>Fishery resources are better managed and conserved.</p> <p>Improved local livelihoods Improved provisioning services (for food resources, e.g. fish)</p>	<p>Fisheries and other government agencies.</p> <p>Number of identified activities in the co-management plan implemented.</p> <p>Number of fishing households (target of up to 150 fishing households actively participating across at least 10 fishing ports in Trat) benefitting from activities to promote sustainable fishing practices and co-management.</p> <p>Number of community-led agreements and training on sustainable fishing practices, supported with improved storage and processing capability to increase market access and reduce wastage implemented.</p> <p>Number of local fishing cooperatives and communities supported.</p>			<p>Rayong provincial government</p> <p>Klaeng district government</p> <p>Pak Nam Prasae TAO</p> <p>Conservation organisations</p>
<p>Strengthen and promote sustainable management and production processes for crab aquaculture.</p> <p>Strengthen local resilience by improving local community</p>	<p>Improved management of Pak Nam Prasae through sustainable fishing and crab aquaculture, and microfinance.</p> <p>Fishery resources are</p>	<p>Standards for sustainable fishing practices developed and agreed with local key stakeholders.</p> <p>Compliance mechanism with penalties and incentives developed and presented with the local stakeholders.</p> <p>Number of consultations conducted with local</p>	500,000	6 years	<p>Department of Fisheries</p> <p>Rayong provincial government</p> <p>Klaeng district government</p> <p>Pak Nam Prasae TAO</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
access to microcredit.	better managed and conserved, ensuring its provisioning services (for food resources, e.g. fish)	<p>stakeholders for a participatory process</p> <p>Number of people engaged in the development of standards for sustainable fishing practices and compliance mechanism.</p> <p>Number of local certifications achieved.</p> <p>A microfinance facility established (or strengthened), with governance structures in place, and involving key stakeholders.</p> <p>Number of households (target of up to 200 households involved in aquaculture and fisheries) benefitting from the grants and loans through the microfinance facility.</p> <p>Number of local fishing and shellfishery cooperatives and communities established and supported through the finance mechanism.</p> <p>A skill training and financial training for fishery workers.</p> <p>Number of training activities conducted for fishery workers.</p> <p>Number of people trained in the skill and financing training for fishery workers.</p>			<p>Aquaculture operators, fishpond owners</p> <p>Aquaculture cooperatives</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Implement initiatives to promote gender inclusion, better work conditions, skill training and finance management for women and migrant workers in aquaculture and fishery sector (from Cambodia and Myanmar)	Improved wetland management through an increased inclusivity in skills training and finance management for local communities, particularly with vulnerable groups (i.e. women, migrant workers)	<p>Assessment study to identify barriers, determine needs for job market entry and better working conditions for fishery workers, and next steps for inclusive practices developed and presented with local stakeholders.</p> <p>Number of consultations conducted with key stakeholders, particularly with the vulnerable groups.</p> <p>Number of people from the vulnerable groups (i.e., women, youth, migrant workers) engaged in the assessment study and training development.</p> <p>A training program on skills development and finance management for women and migrant workers developed.</p> <p>Number of (target of up to 200 women from local and migrant communities) trained.</p>	100,000	2 years	<p>Rayong provincial government</p> <p>Klaeng district government</p> <p>Pak Nam Prasae TAO</p>
<b>Component 3. Strengthening capacity for small-scale tourism</b>					
Strengthen the local capacity for nature-based tourism using participatory approaches  Exchange visits organised with Pak Thale and Khok Kham.	Improved management of Pak Nam Prasae through nature-based tourism benefits, increased capacity for local communities and operators on nature-based	<p>A training program on alternative livelihood (i.e. tourist guide) developed for local communities.</p> <p>Number of people trained (target of up to 50 new local guides and tourism operators) on nature-based tourism.</p>	100,000	5 years	<p>Department of Tourism</p> <p>ONEP</p> <p>BCST</p> <p>Khok Kham <i>tambon</i> administration</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	tourism, and microfinance mechanism.	Number of training and nature-based tourism activities implemented.  Number of people benefiting from the nature-based tourism activities.			Local conservation groups (e.g. Khok Kham Bird Club)
Build local capacity (for local operators) to support tourism, with a focus on domestic tourists  Exchange visits organised with Pak Thale and Khok Kham.		A training programme established for supporting businesses (cafes, shops).  Number of tourism operators trained on nature-based tourism and microcredit mechanism.  A microcredit mechanism established to support local tourism operators.  Number of local tourism operators benefitting from the developed microcredit mechanism	200,000	5 years	
<b>Total investment for 5-6 years</b>			<b>9,500,000 USD</b>		

## 7.2. Potential Financing

The estimated project cost is USD 9,500,000 over 5-6 years. This budget supports the development of site management and co-management framework, the promotion of sustainable fishing practices, the establishment of microfinance mechanisms, alternative livelihood, increased legal protection for the Pak Nam Prasae through local and/or international designation, and capacity-building for local stakeholders in biodiversity monitoring and nature-based tourism. Table 4 summarizes the projected budget distribution across the proposed project components.

If the proposed USD 200,000 investment over five years is allocated to restoring degraded mangrove forests and habitats along the Pak Nam Prasae coast, it could enable the rehabilitation of up to 50 hectares of degraded mangroves and disused fishponds. With estimated coastal protection benefits of USD 300 per hectare annually (see Section 5.3), this intervention could yield approximately USD 15,000 in annual benefits – amounting to around USD 75,000 over five years. This suggests a benefit–cost ratio of approximately 0.4:1 for the restoration component alone, indicating modest direct returns when

considering only coastal protection. However, when combined with complementary investments in suitable nature-based solutions – such as enhancing coastal protection using natural materials along vulnerable sections of the Rayong coastline – this integrated approach supports long-term climate resilience, shoreline stability, and wetland health. Neglecting these interventions would mean continued habitat degradation, reduced adaptive capacity to coastal hazards, and the erosion of valuable ecosystem services that benefit both local communities and biodiversity.

### 7.3. Proposed Institutional Arrangements

The project is expected to be led and coordinated on-site by the Klaeng district and (Pak Nam Prasae *tambon*) government, potentially with support from conservation organisations (e.g. BCST) and national government agencies such as the DMCR. The timeframe of the project is expected to span at least six years, with interventions on fisheries and aquaculture spanning at least five years.

### 7.4. Project Beneficiaries

An estimated 4,700 people live within the site. About half of the people who live along the coast are directly involved with fishing and aquaculture (e.g. sea fishing, shrimp farming, crab aquaculture) and brackish-water fish farming.

There are no indigenous peoples in this landscape. However, there are opportunities for improving working conditions for migrant workers (especially female workers from Cambodia) and building the capacity and skillsets of aquaculture and fishery workers, given the high proportion of migrant workers in the fisheries sector in Rayong.

### 7.5. Anticipated Implementation Risks

*Stakeholder engagement:* Proposed interventions rely on support from local communities, particularly in adopting sustainable fishing practices and co-management. Establishing strong stakeholder buy-in from local leaders and community engagement will facilitate better implementation of the proposed interventions.

Scoping studies on gender and the wider benefits and risks for local communities will help assess the potential socioeconomic impacts of proposed projects.

There is also a genuine risk that coastal restoration work, if poorly designed and managed, may result in biodiversity loss, including increased disturbance to migratory shorebirds.

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## Annex 1. Supplementary information on coastal protection services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co\$tingNature (Mulligan, 2022). Estimates for coastal protection by mangroves (after the effects of coral reefs) were spatially inferred in QGIS from a selection of metrics expressing different biophysical and monetary values modelled by Chaplin-Kramer et al. (2023) and Menéndez et al. (2020), respectively.

The key metrics selected for biophysical values (Table A1) were current maximum potential exposure to coastal hazards, which is a vulnerability risk index calculated in InVEST<sup>11</sup> for several hazard variables (i.e., wind, waves, sea level rise, geomorphology, and bathymetry) in the hypothetical absence of current mangrove extent, and nature’s (i.e., the mangroves’) contribution to reducing this coastal risk, both as an absolute value multiplied by the local population affected and a percentage of the maximum potential exposure.

**Table A1.** Contribution of mangroves to coastal protection as a critical natural asset in Pak Nam Prasae based on site-level (biophysical) values inferred from Chaplin-Kramer et al. (2023) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

<b>Critical contribution of mangroves to coastal protection (metrics)</b>	<b>Risk levels</b>
Current population density within 2.5 km of the coast (number of people per hectare)	333 – 348
<i>Current maximum coastal risk to be mitigated, or potential exposure to coastal hazards (unitless index)</i>	<i>2.44 - 2.83</i>
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #1 ‘Sustainability’ (unitless index)	2.74 - 3.18
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #3 ‘Regional Rivalry’ (unitless index)	2.93- 3.40
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #5 ‘Fossil-fueled Development’ (unitless index)	3.19- 3.70
Current proportional risk reduction, nature’s contribution to reducing coastal risk as a proportion of maximum coastal risk (unitless index)	0.16- 0.16
<i>Nature’s contribution to reducing coastal risk as a proportion of population density within 2.5 km of the coast (# of people per hectare)</i>	<i>52 – 54</i>
<i>Nature’s contribution to reducing coastal risk as a percentage of the maximum potential exposure (%)</i>	<i>5.50 - 6.39</i>

The key metrics selected for economic values (Table A2) were the annual expected flood protection benefits to total stock, which is the monetary value of the averted damages to the industrial and residential stocks (i.e., property) in 2015 US\$, the same total annual benefits expressed per hectare of mangroves, and the total benefits in the event of a 100-year return period storm, which are the rarest of cyclonic conditions but cause the most flood damages to property (i.e., maximum level of coastal protection by mangroves).

**Table A2.** Coastal protection benefits offered by mangroves in Pak Nam Prasae based on site-level (monetary) values inferred from Menéndez et al. (2020) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

<b>Benefits of mangroves in terms of coastal protection (metrics)</b>	<b>Avoided costs (US\$)</b>
Mangrove extent (hectares) <sup>21</sup>	(25) – 515
Annual expected flood protection benefits to people (number of people)	(1,788) – 2,432
Annual expected flood protection benefits to Industrial Stock (US\$)	(1,922,586) - 2,630,648
Annual expected flood protection benefits to Residential Stock (US\$)	(1,332,622) - 1,823,408
<i>Annual expected flood protection benefits to Total Stock (US\$)</i>	<i>(3,207,046) - 4,141,865</i>
<i>Annual expected flood protection benefits to Industrial Stock per hectare of mangroves (US\$ per hectare)</i>	<i>(1,629) - 2,230</i>
1-in-100-year return period damage in terms of area flooded (number of hectares)	(60) – 245
<i>Total expected flood protection benefits of mangroves per 100-year return period storms (US\$)</i>	<i>(943,473) - 3,872,987</i>

**Table A3.** Biophysical benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

<b>Site name</b>	<b>Max pot exp (index)</b>	<b>Risk reduction (index * pop)</b>	<b>Risk reduction (% max pot exp)</b>
Bang Pu	No Data	No Data	No Data
Khlong Tamru (Bang Pakong)	3.22 (±0.17)	147 (±39)	4.87 (±0.25)
Khlong Yai	2.15 (±0.07)	59 (±16)	7.27 (±1.91)
Koh Kham	3.02 (±0.09)	0 (±0)	5.18 (±0.16)
Ta Libong	2.63 (±0.07)	21 (±1)	6.21 (±0.34)
Krabi Estuary	2.69 (±0.07)	17 (±1)	5.68 (±0.28)
Pak Nam Prasae	2.63 (±0.20)	53 (±1)	5.94 (±0.44)
Pak Thale	3.23 (±0.08)	28 (±8)	3.36 (±0.85)
Ao Phang Nga	2.45 (±0.10)	12 (±1)	6.02 (±0.35)
Thailand RFI average	2.75	63	5.44
Thailand national average	2,70	30	3.92

**Table A4.** Monetary benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

<b>Site name</b>	<b>Total annual benefits (US\$)</b>	<b>Per mangrove area (US\$/ha)</b>	<b>For 100-yr return period storms (US\$)</b>
Bang Pu	723,608 (±1,023,384)	985 (±1,393)	1,252,086 (±1,252,144)
Khlong Tamru (Bang Pakong)	4,064,792 (±101.810)	1,698 (±43)	1,028,638 (±46,938)

Site name	Total annual benefits (US\$)	Per mangrove area (US\$/ha)	For 100-yr return period storms (US\$)
Khlong Yai	299,013 (±35,045)	37 (±4)	0 (±0)
Koh Kham	9,699,944 (±5,444,336)	12,815 (±7,193)	17,562,472 (±14,369,473)
Ta Libong	0 (±0)	0 (±0)	3,564,916 (±55,274)
Krabi Estuary	0 (±0)	0 (±0)	4,150,201 (±45,319)
Pak Nam Prasae	557,410 (±3,584,456)	300 (±1,929)	1,464,757 (±2,408,230)
Pak Thale	806,609 (±1,685,154)	1,967 (±4,109)	962,707 (±1,130,299)
Ao Phang Nga	81,744 (±96,861)	86 (±102)	5,723,399 (±12,351,015)
Thailand RFI average	1,803,680	1,987	3,967,686
Thailand RFI total	16,233,119	Not Applicable	18,146,703
Thailand national average	789,242	2,702	9,197,142
Thailand national total	85,257,773	Not Applicable	377,082,842

**Table A5.** Key habitat types in Pak Nam Prasae based on stakeholder-based assessment at the Regional Flyway Initiative workshop in November 2023.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Permanent shallow marine waters	569.0	45.0	448.9	35.5
Intertidal mud, sand or salt flats	151.7	12.0	139.1	11.0
Sand, shingle, or pebble shores	63.2	5.0	88.5	7.0
Aquaculture ponds	379.3	30.0	505.8	40.0
Estuarine waters	19.0	1.5	25.3	2.0
Permanent rivers/streams/creeks	56.9	4.5	50.6	4.0
Intertidal forested wetlands	25.3	2.0	6.3	0.5
<b>Total</b>	<b>1264.4</b>	<b>100.0</b>	<b>1264.4</b>	<b>100.0</b>