Regional Flyway Initiative · Site Study

January 2026

RFI Priority Site · Bueng Boraphet

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General Site Information

Country	Thailand			
RFI Site Name	Bueng Borapet			ID128
City/ Municipality, Province, Region	Mueang Nakhon Sawan, Tha Tako and Chum Saeng districts, Nakhon Sawan Province			
Geographical coordinates	15.70 N, 100.24 E		Area (has)	46,120
Key species	Baer's Pochard			
Key habitats (biomes)	Inland freshwater wetlands			
Key ecosystem services	Provisioning services (major source of freshwater), regulating services and recreational services (tourism)			
Key drivers of change	Habitat degradation, pollution arising from agriculture and industries			
Conservation status (mark all that applies)		Protected Area		Flyway Network Site
		Ramsar Site		Others _____
IBA/ KBA name (and number) and other designations	Bung Boraphet			
Management Stakeholders	Department of National Parks (DWNP), District governments of Mueang Nakhon Sawan, Tha Tako and Chum Saeng, Department of Water Resources			
With management plan?				
Project concept themes	Site management, biodiversity-friendly rice agriculture, tourism			
Length of project	5 years			
Sector/s	Agriculture, tourism			
No. of potential beneficiaries	About 30,000 people live around the lake, including some 5,100 fishermen, and as many as a million people may be directly dependent on resources from the wetlands here, especially freshwater.			
Indigenous Peoples		No		Yes _____
Anticipated Implementation Risks	None anticipated; but likely short-term disturbance through tourism expansion.			
Estimated Project Budget (US$)	12,500,000			
Potential Source/s of Financing		Loan (to be identified)		Private Sector
		Grant (to be identified)		Public-Private Partnership

Table of Contents

Acronyms

ADB	Asian Development Bank
AWC	Asian Waterbird Census
BCST	Bird Conservation Society of Thailand
BBRS	Bueng Boraphet Research Station
CSR	Conservation Status Review
DOF	Department of Fisheries
DMC	Developing Member Country
DMCR	Department of Marine and Coastal Resources
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	*Tambon* Administrative Organisation
TESSA	Toolkit for Ecosystem Services Assessment
USD	United States Dollars

Executive summary

Bueng Boraphet is located about 250 km north of Bangkok and is the largest freshwater wetland in central Thailand (>40,000 ha). It was originally a large, natural floodplain wetland near to the confluence of the Nan and Ping in the Chao Phraya basin, but it was flooded in 1927-1930 when a dam was built to help develop the fishery. Today, the wetland is now centred on a large, shallow lake with several islands just south of the provincial capital of Mueang Nakhon Sawan. The wider landscape around the Bueng Boraphet wetlands is dominated by is surrounded by rice paddies, swampy wetlands and limited areas of grassland. Embankments have been constructed in some areas around the lake, together with spillways and lock gates to regulate water levels and manage flooding during the monsoon seasons. There are extensive, dense mats of floating vegetation on the lake surface and some emergent vegetation, reedbeds and woodland around the margins. Bueng Boraphet is one of Thailand's most important freshwater wetlands and supports large numbers of migratory and resident waterbirds. Recent surveys found that at least six migratory waterbird species regularly exceed 1% of flyway populations there. This site used to support a significant wintering population of the Critically Endangered Baer's Pochard *Aythya baeri* (with high counts of up to 426 individuals), but today it is at best an irregular visitor in small numbers, reflecting its rapid decline. Bueng Boraphet is also notable as the only site in the world where White-eyed River Martin *Eurochelidon sirintarae* has been recorded, an enigmatic species known from a handful of specimens and sightings, but with no confirmed records since 1978.

Bueng Boraphet was designated as a Non-Hunting Area in 1975 with the Department of Wildlife and National Parks (DWNP) being its management authority; DWNP also manages a research station at the wetlands which undertake scientific and monitoring activities. About 30,000 people live around the lake, including some 5,100 fishermen, and as many as a million people may be directly dependent on resources from the wetlands here, especially freshwater. The principal activities in the surrounding areas are rice cultivation, cattle grazing, and pig farming. Bueng Boraphet supports a growing tourism industry, and many visitors stay in the Non-Hunting Area headquarters and hire local boatmen to take boat tours on the lake. Stakeholder consultations at the RFI workshop for Thailand identified provisioning, regulating, and cultural ecosystem services as the most important services for the site, which are all projected to increase in importance in the future. Provisioning services (particularly fresh water and food) are of growing importance for both local and broader populations. Regulating services, such as flood hazard and fire regulation, are crucial for the site, not surprisingly given the wetland's location on a major floodplain.

To improve management and conservation of Bueng Boraphet's wetlands, there is considerable scope for (1) strengthening legal protection and management of the wetlands whilst improving biodiversity monitoring; (2) addressing water pollution; and (3) improving the management of invasive species such as the water hyacinth. The tourism infrastructure can be upscaled by (1) improvement of ecotourism infrastructure, including boardwalks, signage, and viewing structures; and (2) building the capacity of local communities and local businesses to develop small-scale tourism operations. In the area around the lake, there is considerable potential to work with the local communities for (1) scaling up of sustainable, regenerative rice-farming in the paddies around the lake, using wildlife-friendly approaches; and (2) Improved management of agro-chemical waste (both chemical and plastic waste).

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 more than 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). 15 EAAF species exceeded the 1% threshold at the site level in Thailand, with species such as Spotted Greenshank 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, Great Knot, and Sarus Crane.

2. Site profile of Bueng Boraphet

Location: Bueng Boraphet lies about 250 km north of Bangkok in Nakhon Sawan and is the largest freshwater wetland in central Thailand. It is also among the most important inland wetlands for waterbirds in Thailand, together with several sites in the Mekong watershed (in north-east Thailand). Bueng Boraphet is located 2.5-21.0 km east of the provincial capital of Nakhon Sawan, Mueang District, Nakhon Sawan Province, and south of the Nan River close to its confluence with the Ping River, and overlaps with the districts of Mueang Nakhon Sawan, Tha Tako and Chum Saeng.

Area: The Bueng Boraphet RFI site covers an area of 46,120 ha, while the Non-Hunting Area covers slightly over 10,000 ha (data: ONEP).

Altitude: 24 m asl.

Geographical coordinates: 15.70º N, 100.24º E

Description of site: Bueng Boraphet was originally a large swamp of the floodplains of the Ping and Nan River, but it was flooded in 1927-1930 when a dam was built to help develop the fishery, and the wetland is now centred on a large, shallow lake with several islands. The average depth of the lake is only about 1.6 m, reaching its maximum depth in the late wet season (October), and usually at its shallowest in August. The lake is surrounded by rice paddies, swampy habitats (including sedge beds and lotus swamps) and some patches of grassland. Embankments have been constructed in some areas around the north and west margins of the lake, together with spillways and lock gates to regulate water levels. The western shore is fringed by a railway line and lies close to Mueang Nakhon Sawan. There are extensive, dense mats of floating vegetation on the lake surface and some emergent vegetation around the margins.

Site administration, management and land tenure: Bueng Boraphet was designated as a Non-Hunting Area in 1975, covering the lake and some surrounding areas of rice paddy, and fishing is forbidden in certain parts of the lake. The lake is state owned, although there are now many illegally established households around the shoreline, and the surrounding areas are mainly in private ownership.

Social and economic values: Approximately 30,000 people live around the margins of Bueng Boraphet, including some 5,100 fishermen, and as many as a million people may be dependent on the resources from the swamp basin. The principal activities in surrounding areas are rice cultivation (one crop of wet-season rice per year, irrigated with water from the lake), cattle grazing and pig farming. Small areas of corn, mung beans, cotton and groundnuts are grown in the upland areas around the basin. Bueng Boraphet is an important tourist attraction, and many people visit and stay in the Non-Hunting Area

headquarters and hire local boatmen to take rides on the lake. A recently constructed boardwalk leads from the parking area and kiosks to an observation point.

Figure 1. Map of Bueng Boraphet, showing its boundary (in blue) and location within Thailand (in pink) (data from EAAFP Site Information Sheet).

3. Biodiversity value of Bueng Boraphet

3.1. Key habitats

Bueng Boraphet was originally a large swamp of the floodplains of the Ping and Nan River, but it was flooded in 1927-1930 when a dam was built to help develop the fishery, and the wetland is now centred on a large, shallow lake with several islands. The average depth of the lake is only about 1.6 m, reaching its maximum depth in the late wet season (October), and usually at its shallowest in August. The lake is surrounded by rice paddies, swampy habitats (including sedge beds and lotus swamps) and some patches of grassland.

3.2. Importance of Bueng Boraphet for migratory waterbird species

Bueng Boraphet is one of Thailand's most important freshwater wetlands and supports large numbers of both migratory and resident waterbirds. Count data from the 2017 and 2018 Asian Waterbird Census (AWC), and two datasets on the 2022 AWC, was averaged for these three years in the RFI analysis for Bueng Boraphet and then compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. Six species were found to regularly exceed the 1% population estimates based on recent data (Table 1), and the CSR1 scores for these species were summed to provide the overall site score. Bueng Boraphet was also found to support significant numbers of three globally threatened and near-threatened waterbird species, Painted Stork *Mycteria leucocephala* (NT), Baer's Pochard *Aythya baeri* (CR) and Black-tailed Godwit *Limosa limosa* (NT).

Table 1. List of migratory species (based on the EAAFP list of species) with globally significant congregations in Bueng Boraphet.

Scientific name	IUCN	Average count	CSR1	CSR1 score
Glossy Ibis *Plegadis falcinellus*	LC	2,977	250	11.9
Asian Openbill *Anastomus oscitans*	LC	6,317	3,000	2.1
Intermediate Egret *Ardea intermedia*	LC	1,885	1,000	1.9
Great Egret *Ardea alba*	LC	1,834	1,000	1.8
Garganey *Spatula querquedula*	LC	2,109	1,400	1.5
Black-winged Stilt *Himantopus himantopus*	LC	9,208	10,000	0.9

Bueng Boraphet used to support a substantial non-breeding population of Baer's Pochard *Aythya baeri* (CR) (with high counts of up to 426 individuals), but it is now an irregular visitor in small numbers, reflecting the rapid global decline of this Critically Endangered species. Most sightings involve a few individuals or singletons today. Several other near threatened migratory waterbirds have occurred at the site in the past, including Spot-billed Pelican *Pelecanus philippensis* (NT), Ferruginous Duck *Aythya nyroca* (NT), Painted Stork *Mycteria leucocephala* and Black-headed Ibis *Threskiornis melanocephalus*.

3.3. Other notable biodiversity

Bueng Boraphet is the only site in the world where White-eyed River Martin *Eurochelidon sirintarae* (CR) has been recorded. This enigmatic species is known from just a handful of specimens and sightings, including the type which were collected here from large roosts of the Barn Swallow *Hirundo rustica*. There are no confirmed records since 1978. In the late 2010s, the localised and Near Threated Marsh Grassbird *Megalurus pryeri* was discovered in the wetlands around the lake for the first time.

Several globally threatened mammal and fish species occur at Bueng Boraphet, including Fishing Cat *Prionailurus viverrinus* (VU), Flying Minnow *Laubuka caeruleostigmata* (EN), *Urogymnus polylepis* (Thailand subpopulation) (CR), and White-edge Whipray *Fluvitrygon signifier* (EN).

4. Ecosystem services

4.1. Ecosystem services provided by Bueng Boraphet

Bueng Boraphet overlaps with diverse wetland habitats, offering valuable provisioning, regulating, and cultural ecosystem services (Figure 2). Provisioning services, particularly fresh water and food, benefit communities both within, adjacent to, and distant from the site (see Table 2). Both services have shown an increase in the past and are projected to continue increasing in the future, underscoring their growing importance for local and broader populations. Regulating services, such as flood hazard regulation and fire regulation, are crucial for the site, positively impacting communities within and adjacent to the area. Both services have experienced an increase in the past and are expected to continue rising, contributing to the site's environmental resilience. Cultural services, especially recreation and ecotourism, significantly benefit communities at all distances. This service has increased in the past and is anticipated to keep growing, reinforcing Bueng Boraphet's importance as a vital resource for both local enjoyment and tourism.

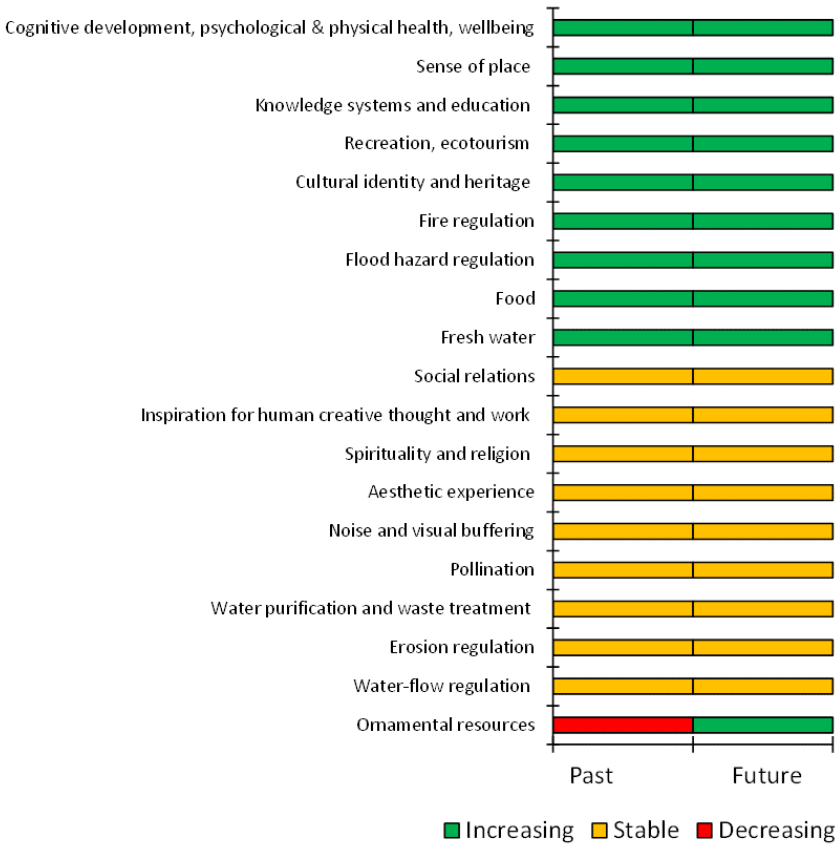

Figure 2. List of ecosystem services provided by Bueng Boraphet, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

Table 2. List of top ecosystem services provided by Bueng Boraphet.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
Provisioning services						
Fresh water	Yes	✓	✓	✓	Increase	Increase
Food	Yes	✓	✓	✓	Increase	Increase
Regulating services						
Flood hazard regulation	Yes	✓	✓		Increase	Increase
Fire regulation	Yes	✓	✓		Increase	Increase
Cultural services						
Recreation, ecotourism	Yes	✓	✓	✓	Increase	Increase

4.2. Flood mitigation services

The flood mitigation services provided by Bueng Boraphet were assessed using biophysical values only (see Table A1 and Annex 1 for details). When compared to both the average of the three RFI inland sites prioritised (in Buriram) and the average of all other inland wetlands in Thailand (Table A2 in Annex 1), Bueng Boraphet shows some consistent results in terms of benefits and beneficiaries:

(1) for the average green storage capacity per sq. km of wetland, Bueng Boraphet is above average, however slightly (228 Giga Litres or GL of water per km^2 vs. 226 GL/km^2 for RFI inland sites and 216 GL/km2 for all other inland wetlands);

(2) for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Bueng Boraphet is also above average (647 vs. 251 people/km^2 RFI inland sites and 202 people/km2 for all other inland wetlands); and

(3) for the average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland, Bueng Boraphet is again well above average (32.90 ha/km^2 vs. 12.42 ha/km^2 for RFI inland sites and 11.30 ha/km^2 for all other inland wetlands).

5. Drivers of change and their potential impacts on Bueng Boraphet

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop[1] identified several drivers of change impacting Bueng Boraphet. High-impact drivers include the activities of site managers, which significantly alter the natural environment (Table 3). Agricultural and forestry effluents, air-borne pollutants, and annual and perennial non-timber crop production contribute to habitat degradation and water quality issues. Commercial and industrial areas, dams (both within and upstream), and hydrological modifications affect the site's natural water flow. Additional high-impact factors include drought conditions, erosion and siltation, excess ponding of water, fire, fishing, garbage and solid waste, habitat clearing, housing and settlement development, hunting, increased fragmentation, invasive species, and loss of keystone species. Infrastructure developments, such as ports and shipping lanes, and other factors like mining, aquaculture, and road construction, also pose substantial threats to the wetland's ecological integrity.

[1] 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

Medium-impact drivers include the collection of terrestrial plants, energy generation activities (such as hydropower dams), and household sewage and urban wastewater from outside the site, which contribute to moderate levels of habitat and water quality degradation. Additional medium-impact factors include industrial mining, the natural deterioration of cultural wetland values, tourism infrastructure, vandalism, and desertification.

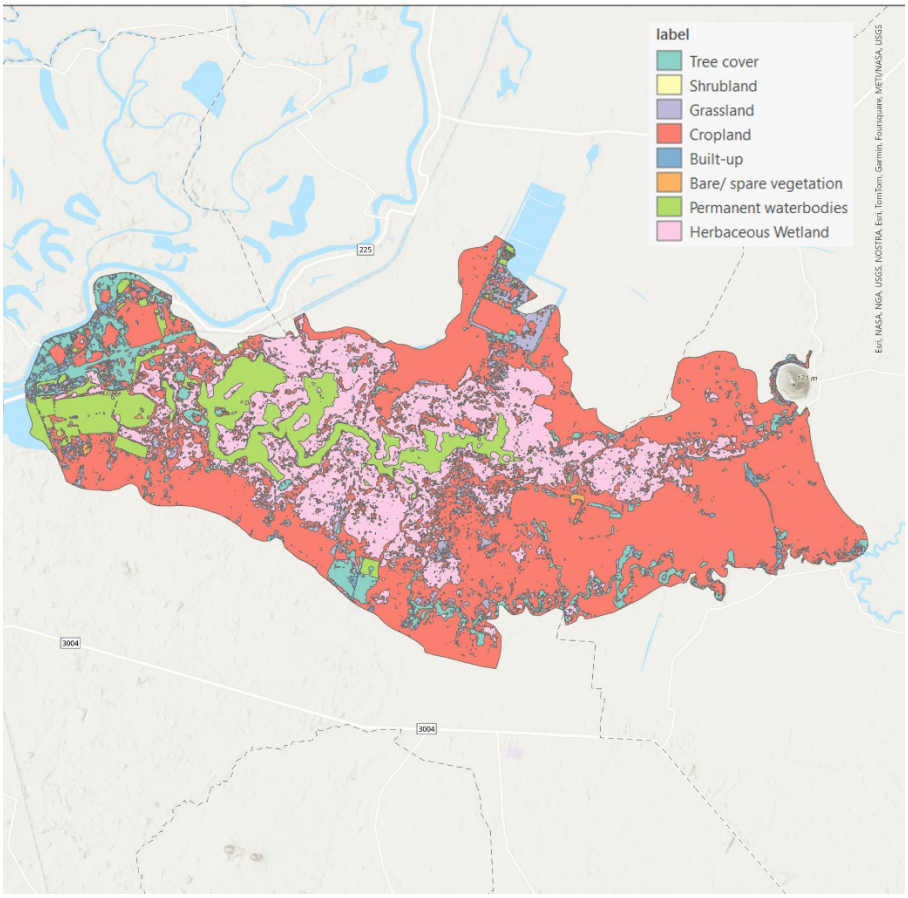

Figure 3. Major land cover types in Bueng Boraphet wetlands based on remotely sensed data (Map: Radhika Bhargava)

Table 3. Drivers of change and their potential impact on the integrity of Bueng Boraphet based on consultations with stakeholders.

Driver of change	Impact
Activities of site managers	High
Agricultural and forestry effluents	
Air-borne pollutants	
Annual and perennial non-timber crop production	
Commercial and industrial areas	
Dams within or upstream of the wetland site, which alter the hydrological regime	
Dams, hydrological modification and water management/use	
Drought conditions	
Droughts	
Erosion and siltation/deposition	
Excess energy	
Excess ponding of water onsite	
Fire and fire suppression	
Fishing, killing and harvesting of aquatic resources	
Garbage and solid waste	
Habitat clearing	
Habitat shifting and alteration	
Housing and settlement	
Hunting, killing and collecting of terrestrial animals	
Increased fragmentation within the wetland site	
Introduced genetic material	
Invasive animal species	
Invasive plant species	
Isolation from other natural habitats	
Livestock farming and grazing	
Loss of cultural links, traditional knowledge and/or management practices	
Loss of hydrological connectivity	
Loss of keystone species	
Marine and freshwater aquaculture	
Mining and quarrying	
Oil and gas drilling; extraction of sand	
Other 'edge effects' that degrade the wetland site values	
Pathogens	
Ports with large scale loading and unloading of goods	
Recreational activities and tourism	
Restoration for conservation	
Roads and railroads	
Sewage and wastewater from wetland site facilities	
Shipping lanes and canals	
Storm and flooding	
Temperature extremes	
Utility and service lines	
Water extraction/diversion within the wetland site or catchment	
Collecting terrestrial plants or plant products (non-timber)	Medium
Destruction of cultural heritage buildings, gardens, sites, etc.	
Energy generation, including from hydropower dams, wind farms and solar panels	
Household sewage and urban wastewater from outside the wetland site	
Industrial, mining and military effluents	
Natural deterioration of important cultural wetland site values	
Tourism and recreation infrastructure	
Vandalism, destructive activities or threats to staff and visitors	
Desertification	Low
Flight paths	
Research, education and other work-related activities	

5.2. Potential alternative state of Bueng Boraphet under current drivers of change

Stakeholders at the RFI workshop[2] 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

[2] 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

(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.

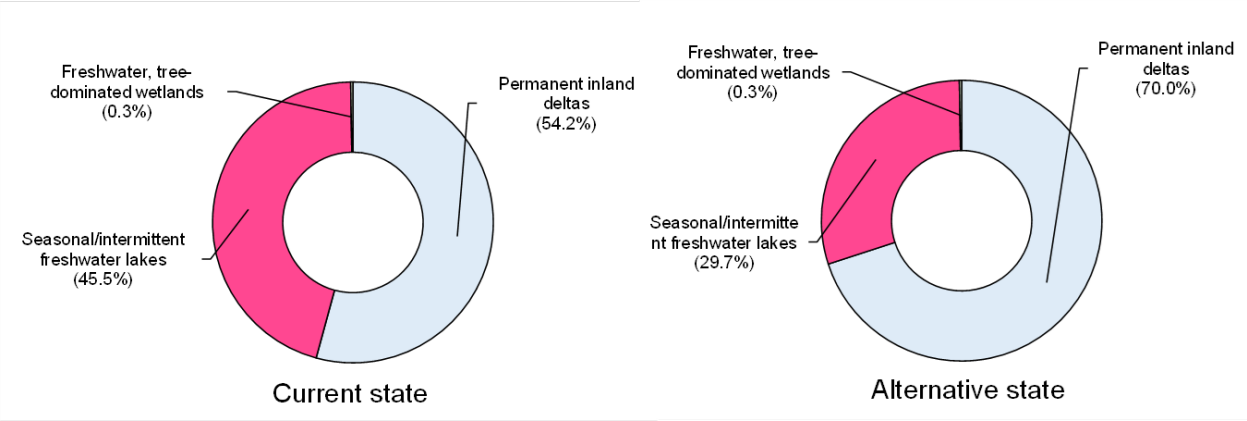

Figure 4. The proportional change in the extent of different habitat types between the current and alternative states of Bueng Boraphet.

5.3. Expected changes in the ecosystem services of Bueng Boraphet

Stakeholders at the RFI workshop[3] documented the future trends in the provision of ecosystem services in Bueng Boraphet, 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.

Bueng Boraphet overlaps with diverse wetland habitats, offering valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop[4] highlights the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, particularly fresh water and food, benefit communities both within, adjacent to, and distant from the site. Both services have shown an increase in the past and are projected to continue increasing in the future, underscoring their growing importance for local and broader populations. Regulating services, such as flood hazard regulation and fire regulation, are crucial for the site, positively

[3] 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

[4] 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

impacting communities within and adjacent to the area. Both services have experienced an increase in the past and are expected to continue rising, contributing to the site's environmental resilience. Cultural services, especially recreation and ecotourism, significantly benefit communities at all distances. This service has increased in the past and is anticipated to keep growing, reinforcing Bueng Boraphet's importance as a vital resource for both local enjoyment and tourism.

As presented in Table A5, a net loss of 1,687 hectares of green water habitats from the conversion of seasonal/intermittent freshwater lakes to permanent inland deltas (i.e., blue water storage), is expected to result in a severe effective reduction of 34.5% or 79 Giga Litres of green storage capacity per km². This loss, calculated relative to the core green water habitat area, may amount to nearly 220 people and 11 hectares of built-up areas losing flood mitigation benefits per km² of wetland.

6. Capacity needs in Bueng Boraphet

The stakeholder consultation and analyses with government and civil society stakeholders identified five stakeholder groups with clear roles in the long-term sustainable management of Bueng Boraphet wetlands. Table 4 summarizes the current and potential roles of these stakeholder groups in relation to the management of the Bueng Boraphet wetlands. There are opportunities to strengthen tourism, technology use in establishing feedback systems on water usage, wetland ecosystem services, and others to be identified with the community.

Table 4. Capacity needs for the management of Bueng Boraphet, based on RFI stakeholder consultations.

Stakeholder group	Current role in wetland management	Possible future role in wetland management	Current capacity for sustainable wetland management	Capacity development needed to improve wetland management	Form of capacity development (e.g. training, organisational strengthening etc.)
Local communities	Establish local community organisations of end-users to strengthen the management process.	Expand the user network and better understand their needs.	Limited, but there is potential for larger roles in water resource management.	Coordinate the sharing of information between across stakeholders. Use technology to help establish feedback systems on water usage.	Training and awareness programmes to understand water usage across stakeholders
Tourism operators (e.g.	Attracting tourists, which	Set up cooperatives to	Groups of operators	Support to develop tourism	Provide basic knowledge

Stakeholder group	Current role in wetland management	Possible future role in wetland management	Current capacity for sustainable wetland management	Capacity development needed to improve wetland management	Form of capacity development (e.g. training, organisational strengthening etc.)
sightseeing boat operators)	generates income for the local economy.	organise and regulate local tourism.	working together share a working relationship and common understanding.	itinerary around existing resources.	training for tour guides and operators.
Government: local administrative offices.	Oversee the improvement of public infrastructure and leading local initiatives.	Manage complementary development projects for the site	Capacity to work closely with the locals and local community.	Better appreciation of wetland ecosystems	Strengthen the capacity of personnel working with the community. Develop regulations for the local communities.
Government: Royal Irrigation Department (RID).	Improve and manage community water sources for local communities.	Ensure integration with other relevant agencies.	Ensure consistency of information and rationales across the board.	Understand community needs before launching initiatives.	Collect data for improving infrastructure.
Government: management of Non-hunting Area (NHA)	Protect and monitor the NHA; enforce regulations.	Enhanced protection for the site. Expand the protected area. Integrated area.	Ecological data deficient.	Survey and create a collective database to study the economic value of ecosystem services.	Strengthen work and collaborations with other stakeholders.

7. Opportunities for RFI interventions

7.1. Recommended Interventions

Bueng Boraphet is the largest freshwater wetland in central Thailand and supports globally significant congregations of both migratory and resident waterbirds. It was originally a large floodplain swamp in the Chao Phraya Basin, but it was flooded in 1927-1930 when a dam was built to help develop the fishery, and the wetland is now centred on a large, shallow lake with several islands, and extensive floating and lakeside vegetation. Bueng Boraphet is designated as a Non-Hunting Area with the DNP its management authority. The site covers lake and some surrounding areas of rice paddy, and fishing is forbidden in certain parts of the lake. However, many households have been illegally established around the shoreline and there are problems with invasive species such as water hyacinth. To strengthen management and conservation of Bueng Boraphet, there is a need for: (1) Strengthening legal protection and management of the wetlands; (2) Establishing a local-led biodiversity and wetland monitoring scheme; and (3) Strengthening invasive species management with a focus on water hyacinth.

Bueng Boraphet is also an important tourist attraction, and domestic tourists visit and stay in and around the Non-Hunting Area headquarters and hire local boatmen for boat trips in the lake. A boardwalk leads from the parking area and kiosks to an observation point, which enables visitors to view the wetlands and waterbirds. Nature-based tourism activities at the wetlands are anticipated to keep growing over time, reinforcing Bueng Boraphet's importance as a vital resource for both local people and tourists. This needs to be supported by a commensurate investment into tourism, including (1) Improvement of ecotourism infrastructure at Bueng Boraphet, including boardwalks, signages and viewing structures; and (2) Building capacity of local communities and businesses to develop small-scale tourism operations.

The principal land-use activity in the areas surrounding Bueng Boraphet is rice cultivation, with the rice paddies irrigated with water from the lake. The farmers there currently use agro-chemicals on their rice crops, leading to an inflow of chemical waste into the wetland, and there is considerable potential to work with the local communities for (1) Scaling up of sustainable, regenerative rice-farming in the rice paddies that surround Bueng Boraphet, using wildlife-friendly approaches; and (2) Improved management of agro-chemical waste in the rice paddies around Bueng Boraphet.

Table 5. Summary of key RFI interventions proposed for Bueng Boraphet

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Component 1. Strengthening landscape management of the Bueng Boraphet wetlands					
Conduct a scoping study of existing interventions implemented in Bueng Boraphet,	Best practices, guidelines, and standards for proposed RFI interventions	Assessment report with key threats identified and recommendations for	50,000	1 year	ONEP BCST

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
including targeted work on long-term threats (from climate change and changing hydrology). Identify, successes failures, gaps and lessons for RFI interventions.		improved management published and disseminated to key stakeholders. Number of consultations conducted for participatory processes in the scoping study Number of stakeholder groups engaged in the scoping study			Nakhon Sawan provincial government Mueang, Tha Tako and Chum Saeng (*amphoe*) district government, and relevant TAOs Consultancy companies
Strengthen and expand site management and zonation of the Bueng Boraphet landscape (including the NHA and surrounding landscapes).	Improved management and wetland protection of the Bueng Boraphet landscape through an updated (Ramsar) site management plan over short to medium-term for Bueng Boraphet, and co-management with local community stakeholders. Improved protection of the Baer's Pochard and sensitive waterbird areas through identification, prioritization, and site access management.	Site management plan and zonation plan agreed by key stakeholders and endorsed by the management authority (Bueng Boraphet NHA) Number of consultations conducted to strengthen engagement of local stakeholders for participatory processes Number of implemented activities in the developed site management and zonation plans. Number of stakeholder groups engaged in the development of site management and zonation plans.	100,000	2 years	DWR ONEP DNP/Bueng Boraphet NHA management board Nakhon Sawan Provincial Government *Mueang* Nakhon Sawan District Government BCST and local conservation groups

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Co-management framework developed and piloted. A co-management council, with representatives from key stakeholders, developed. Area demarcated as important and sensitive for waterbird conservation (e.g. for Baer's Pochard) identified and integrated in the site management and zonation plans.			
Strengthen legal protection of Bueng Boraphet	Improved management and wetland conservation for Bueng Boraphet through higher level legal status for Bueng Boraphet, with boundaries of the protected area precisely delineated	Area in Bueng Boraphet delineated for higher legal protected status (beyond Non-Hunting Area) Number of consultations conducted to strengthen engagement of local stakeholders for participatory processes Number of stakeholder groups engaged in site delineation for higher legal protection status.	100,000	5 years	DWNP, including BBRS (Research Station) Mueang, Tha Tako and Chum Saeng (*amphoe*) district government, and relevant TAOs Conservation organisations (including bird and community-focused NGOs)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Establish a locally led biodiversity and wetland monitoring scheme	Improved waterbird conservation through biodiversity monitoring	A biodiversity monitoring framework (and protocols) developed and implemented for the site. Number of studies (e.g., movement ecology) conducted for the priority species Number of biodiversity monitoring activities conducted. Number of locally led conservation groups established and/or supported Number of locally led workplans/ insights developed and integrated in the site management plan.	50,000	5 years	
Strengthen the invasive species management with a focus on water hyacinth *Pontederia crassipes*	Improved management in Bueng Boraphet through invasive species control and management.	Area (target of at least 50 ha) with effective control and management of invasive species including Giant Mimosa and Water Hyacinth Area prioritized for invasive species control and management identified.	200,000	5 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of trials established for managing invasive plants.			
Component 2. Upscaling tourism infrastructure and strengthening sustainable ecotourism					
Improve the ecotourism infrastructure at Bueng Boraphet, including boardwalks, signages and viewing structures (e.g. hides)	Improved protection and management at Bueng Boraphet through ecotourism benefits and increased appreciation of waterbirds and wetland habitats. Ecotourism as a source of local livelihood strengthened.	Number of ecotourism infrastructure (including boardwalks, signage, and viewing structures) established and improved. Number of people and local operators benefitting from ecotourism. Ecotourism strategy and business plans and packages developed and tested, in consultation with local stakeholders and tourist operator Number of local stakeholders and tourist operators engaged in the development of the ecotourism strategy and business plans. Number of nature-based trips organized, based on the developed ecotourism business packages.	500,000	2 years	Department of Tourism Nakhon Sawan Provincial Government Mueang, Tha Tako and Chum Saeng (*amphoe*) district government, and relevant TAOs Ecotourism operators (including local results) Conservation organisations (including bird and community-focused NGOs)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Build the capacity of local communities and businesses to develop small-scale tourism operations	Improved protection and management at Bueng Boraphet through increased capacity on ecotourism and opportunities for local tourism operators.	A capacity-building program on ecotourism for local communities and small-scale tourism operators developed. Number of capacity-building activities implemented. Number of people and local tourism operators (target of up to 50 tourism operators) trained on ecotourism to support domestic and international tourists	100,000	3 years	
Component 3. Strengthening sustainable and/or wildlife-friendly rice farming approaches					
Scale up sustainable, regenerative rice-farming in the rice paddies that surround Bueng Boraphet, using wildlife-friendly approaches	Improved management and biodiversity conservation in the Bueng Boraphet landscape through the practice of sustainable rice farming in adjacent lands.	Area surrounding Bueng Boraphet using wildlife-friendly approach in rice farming. Number of households (target of at least 100) engaged in sustainable rice farming. Training program on sustainable rice farming and wildlife-friendly rice marketing developed for local communities. Number of capacity-building activities on	500,000	5 years	Ministry of Agriculture and Cooperatives Conservation organisations (including bird and community-focused NGOs) Rice farming cooperatives Local conservation groups

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		wildlife-friendly rice farming implemented. Number of rice farmers and other key stakeholders trained on wildlife-friendly rice farming and sustainable product marketing.			
Improve management of agro-chemical waste in the rice paddies around Bueng Boraphet	Improved management and biodiversity conservation in the Bueng Boraphet landscape through agrochemical waste management in rice paddies around Bueng Boraphet.	Number of agrochemical disposal facilities established and improved in all villages (*muban*) Metrics and baselines for improved agrochemical waste management established. Reduced inflow of agro-chemicals into Bueng Boraphet wetlands, based on the established metrics Number of consultations conducted with key stakeholders regarding agrochemical waste management. Number of stakeholder groups engaged in	500,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		agrochemical waste management.			
Component 4. Improvement of waste management infrastructure to address water pollution (including plastic pollution) in Bueng Boraphet					
Assess the extent of water, plastic and solid waste pollution in Bueng Boraphet (e.g. chemical discharges from rice agriculture, tourism establishments)	Improved wetland conservation through better water and solid waste management Possible contamination in water and harvest assessed, measured, and reduced.	Strategy for pollution management developed, with a focus on agriculture, tourism and industrial effluents. Study on causes and impact of water pollution completed Guidelines and recommendations for businesses especially farms and light industries developed and promoted. Number of consultations conducted with key stakeholders on the assessment and strategy development for water and solid waste management Number of stakeholder groups engaged in water and solid waste management.	100,000	2 years	Ministry of Agriculture and Cooperatives DWR Nakhon Sawan Provincial Government Mueang, Tha Tako and Chum Saeng (*amphoe*) district government, and relevant TAOs Tourism businesses Paddy landowners
Improve the management of wastewater (agricultural effluents and pollutants nearby landscapes)	Improved wetland conservation through better wastewater and pollution management.	Number of wastewater management infrastructure (including canals, wastewater disposal areas, and waste treatment facilities) improved.	1,000,000	5 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Regulations and guidelines on wastewater and pollution management improved and disseminated with key stakeholders. Baseline and targets metrics on key chemical and biological contamination in water and harvested shellfish developed. Set target reduction on key chemical and biological contamination in water and harvested shellfish achieved. Number of consultations conducted with key stakeholders, ensuring a participatory process. Number of people engaged in wastewater and pollution management			
Total investment for 5 years			**12,500,000 USD**		

7.2. Potential Financing

The estimated project cost is USD 12,500,000 over 5 years. This budget supports the development of site management and zoning plans, wastewater and pollution management, water and solid waste management, agrochemical waste management, the promotion of wildlife-friendly farming, capacity-building for local stakeholders in biodiversity monitoring and tourism, ecotourism development, and increased legal protection for the Bueng Boraphet wetlands. Table 5 summarizes the projected budget distribution across the proposed project components.

7.3. Proposed Institutional Arrangements

The proposed project is expected to be implemented over a period of up to 10 years, with specific project components focusing on improved site management for the Bueng Boraphet wetlands (led by the Department of National Parks, Department of Water Resources), tourism operators in Nakhon Sawan and various *tambons*, addressing water pollution, strengthening local tourism and rice agriculture management (with Ministry of Agriculture and Cooperatives). The wetlands have a well-established research station, which is expected to deliver project components on field studies and biodiversity monitoring.

7.4. Project Beneficiaries

About 30,000 people live around the lake, including some 5,100 fishermen, and as many as a million people may be directly dependent on resources from the wetlands here, especially freshwater.

Initiatives to promote gender inclusion and the vulnerable and participation in livelihood activities. Limited women involvement at present.

7.5. Anticipated Implementation Risks

Environment: Most proposed interventions are relatively soft and have a low environmental impact, but it may be necessary to consider the effects of expanding tourism in Bueng Boraphet wetlands, which could increase anthropogenic pressures and lead to greater disturbance of wildlife. Planning with stakeholders to reduce noise pollution during the construction of ecotourism facilities and ongoing ecotourism activities, as well as managing waste pollution from increased tourist traffic, is essential.

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Annex 1. Supplementary information on flood mitigation 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 flood mitigation were spatially inferred in QGIS from a selection of metrics expressing different biophysical values modelled online by the Water World component of this tool. Equivalent data to assess monetary values similarly to coastal protection were not available for the RFI region.

The key metrics selected for biophysical values (Table A1) were the average green storage capacity, which is the volume of water stored by each square kilometre of wetland itself as well as its soil and vegetation, and the direct influence of this storage capacity on beneficiaries found downstream of the wetland, both as the average number of people and the average built-up area that are uniquely benefitting from the resulting flood mitigation (and not from other green storage found upstream).

Table A1. Contribution of the wetland habitats to flood mitigation in Bueng Boraphet based on site-level (biophysical) values inferred from Mulligan (2022) and expressed as ranges to represent the resulting uncertainty.

Influence of the wetland on flood mitigation (metrics)	**Benefit/Beneficiaries**
Average green storage capacity per sq. km of wetland in million cubic metres (GigaLitres/km2)	207 – 249
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km2)	588 – 706
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km2)	29.89 – 35.91

Table A2. Biophysical benefits from and beneficiaries of RFI inland wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	**Green storage capacity (GigaLitres/km^2)**	**Downstream population (n /km^2)**	**Downstream built-up area (ha /km^2)**
Bueng Boraphet	228 (±21)	647 (±170)	32.90 (±3.01)
Huai Chorakhe Mak reservoir	95 (±68)	24 (±26)	0.99 (±0.71)
Sanam Bin reservoir	356 (±56)	81 (±27)	3.38 (±0.53)
Thailand RFI average	226	251	12.42
Thailand national average	216	202	11.30

Table A5. Key habitat types in Bueng Boraphet 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 inland deltas	5791.6	54.2	7479.0	70.0
Seasonal/intermittent freshwater lakes	4864.9	45.5	3177.5	29.7
Freshwater, tree-dominated wetlands	27.8	0.3	27.8	0.3
Total	10684.3	100.0	10684.3	100.0