ADB

Regional Flyway Initiative · Site Study

January 2026

RFI Priority Site · Sanam Bin Reservoir

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General Site Information

Country	Thailand			
RFI Site Name	Sanam Bin Non-Hunting Area			ID134
City/ Municipality, Province, Region	Prakhon Chai subdistrict, Prakhon Chai district, Buri Ram Province			
Geographical coordinates	14.64º N, 103.08º E		Area (has)	603 has
Key species	Sarus Crane, and freshwater wetland dependant species (e.g. ibises, Painted Stork)			
Key habitats (biomes)	Marshy grassland			
Key ecosystem services	Provisioning services (freshwater, food) and regulating services (flood protection)			
Key drivers of change	Tourism and expansion of settlements (villages in Prakhon Chai)			
Conservation status (mark all that applies)	■	Protected Area		Flyway Network Site
		Ramsar Site		Others _____
IBA/ KBA name (and number) and other designations	N/A			
Management Stakeholders	Department of Wildlife and National Parks, Department of Water Resources, Prakhon Chai TAO, Buri Ram provincial government			
With management plan?				
Project concept themes	Site management and organic rice agriculture			
Length of project	10 years			
Sector/s	Agriculture			
No. of potential beneficiaries				
Indigenous Peoples	■	No		Yes _____
Anticipated Implementation Risks	Tourism impacts on the site are expected to grow and may cause further degradation of wetlands.			
Estimated Project Budget (US$)	8,980,000			
Potential Source/s of Financing	■	Loan (to be identified)		Private Sector
	■	Grant (to be identified)		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	*Tambon* Administrative Organisation
TESSA	Toolkit for Ecosystem Services Assessment
USD	United States Dollars
ZPOT	Zoological Park Organisation of Thailand

Executive summary

Sanam Bin is essentially a man-made wetland located in Prakhon Chai district in Buri Ram, and lies on the floodplain of the Mun, a tributary of the Mekong. The reservoir that forms much of the site was created in the 1970s by the damming of a natural wetland and is surrounded by an area of marshy grassland. Parts of the reservoir are fringed by emergent vegetation and the areas adjacent to the reservoir are mainly rice cultivation. Sanam Bin Reservoir was declared as a Non-Hunting Area in 1980 under the jurisdiction of the Department of Wildlife and National Parks, with an area station established at the site with a guard. The wetland is under public ownership, but parts of the site have been encroached upon by villagers for housing and cultivated plots, and the surrounding areas are privately owned farmland. Sanam Bin, together with Huai Chorakhe Mak and Huai Talad in Sakae Prong district, is the site of a successful reintroduction programme for the globally threatened eastern population of Sarus Crane which was extirpated in Thailand in the 1970s. This programme is a collaboration between the Government of Thailand, Nakhon Ratchasima Zoo (Korat Zoo), ZPOT and several academic institutions, which made the first crane reintroduction in 2011. Presently, the population of the crane has expanded to over 150 individuals. Sanam Bin's wetlands are also used by wintering congregations of storks, ducks and shorebirds, even though none exceeded regional population thresholds.

Sanam Bin Reservoir and its associated wetlands offer valuable provisioning, regulating, and cultural ecosystem services, which are all projected to increase in importance in the future. Provisioning services, particularly fresh water and food, benefit rice farming communities within and around the site and are expected to increase in the future, indicating their growing importance for local people. Regulating services, particularly flood hazard regulation, benefit communities living in Prakhon Chai and other adjacent subdistricts, and are anticipated to increase in the future, reinforcing their role in environmental management. Cultural services, including recreation, ecotourism and knowledge systems and education, provide significant benefits to local people, and again is projected to increase.

To improve conservation and management of Sanam Bin Reservoir, there is a need for: (1) strengthening legal protection and management of Sanam Bin (2) continuation of study and monitoring of the Sarus Crane population and raising awareness of the cranes and wetland ecosystems; and (3) strengthening invasive species management with a focus on water hyacinth *Pontederia crassipes* and giant mimosa *Mimosa pigra*. Nature-based tourism activities are projected to increase in the future, reinforcing Sanam Bin Reservoir's importance as a source of livelihoods for a major segment of the local population. This may require (1) improvement of tourism infrastructure at Sanam Bin Reservoir, including signages and viewing structures; and (2) building capacity of local communities and businesses to develop small-scale tourism operations. Although organic farming is practiced, many local farmers there currently use agro chemicals on their jasmine rice crops, leading to an inflow of chemical waste into the wetland. There is considerable scope for (1) scaling up of sustainable, regenerative rice-farming or 'Crane Rice' in the rice paddies that surround Sanam Bin Reservoir as has been implemented in Huai Chorakhe Mak; and (2) improved management of agro-chemical waste in the rice paddies around Sanam Bin Reservoir.

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 Sanam Bin Reservoir

Location: Sanam Bin is a water storage reservoir, located two km north of the township (*thesaban tambon*) of Prakhon Chai, in Prakhon Chai District, Buri Ram Province, on the floodplain of the River Mun, a tributary of the Mekong, in eastern Thailand.

Area: The Sanam Bin Reservoir RFI site covers an area of 603 ha.

Altitude: 160 m

Geographical coordinates: 14.64º N, 103.08º E

Description of site: Sanam Bin Reservoir was created in about 1975 by the damming of a natural marshy area. The open water (with a minimum area of 200 ha during the dry season and a water depth of 2-3 m) is surrounded by an extensive area of marshy grassland, and the wetland is fed by many small watercourses which transect the floodplain. The main outflow is via small canals that have been constructed for irrigation and municipal water supply. In the wet season, flooding of the plains is so extensive that the reservoir is linked to flooded areas elsewhere. The site is completely encircled by roads, and one small village named Ban Thi Sawon lies within its boundary. Parts of the reservoir are fringed by *Typha angustifolia*, *Eleocharis* sp. and *Cyperus* sp. and there is a small amount of swamp woodland on the shore. There is a considerable amount of *Nymphaea* sp. on the open water. The areas adjacent to the reservoir are mainly under cultivation, chiefly for rice paddy, but there are some patches of dry dipterocarp woodland.

Site administration, management and land tenure: Sanam Bin Reservoir was declared as a Non-Hunting Area in 1980, with an area station established at the site with a guard. The administrative authority is the Department of Wildlife and National Parks (DWNP). The wetland is under public ownership, but parts of the site have been encroached upon by villagers for housing and cultivated plots. The surrounding areas are privately owned farmland (mostly rice paddies).

Social and economic values: The main land uses at Sanam Bin Reservoir are fishing, keeping of domestic ducks and rice cultivation (one crop of wet-season rice per year) in the seasonally flooded marshland. There is a considerable amount of illegal hunting and frequent incidental disturbance of the waterbirds by fishermen, and parts of the wetland have been encroached upon for cultivation or settlement. The site is an important source of water for household use in Prakhon Chai District.

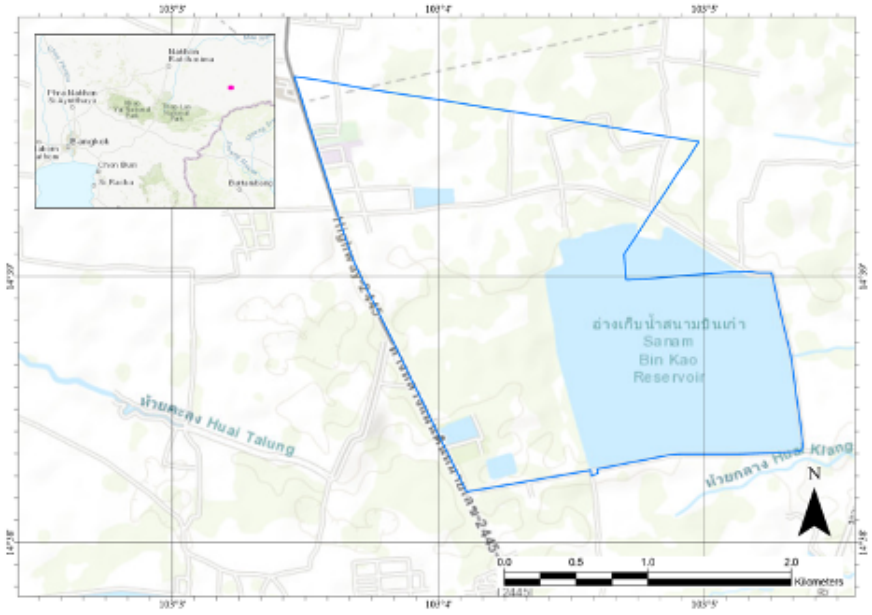

Figure 1. Map of Sanam Bin Reservoir, showing its boundary (in blue) and location within Thailand (in pink) (data from EAAFP Site Information Sheet; map: Evelyn Pina Covarubbias).

3. Biodiversity value of Sanam Bin Reservoir

3.1. Key habitats

Sanam Bin Reservoir was created in about 1975 by the damming of a natural marshy area. The open water (with a minimum area of 200 ha during the dry season and a water depth of 2-3 m) is surrounded by an extensive area of marshy grassland, and the wetland is fed by many small watercourses which transect the floodplain.

3.2. Importance of Sanam Bin Reservoir for migratory waterbird species

Three wetlands in Buri Ram Province, Sanam Bin Reservoir, Huai Chorakhe Mak and Huai Talad Non-Hunting Areas, are the sites of an ongoing reintroduction programme for the globally threatened eastern population of Sarus Crane (ssp. *sharpii*). This programme is a collaboration between the Government of Thailand, Nakhon Ratchasima Zoo (Korat Zoo), ZPOT and several academic institutions, which began in 1989 and made the first crane reintroduction in 2011 (Li et al. 2023). Recent data suggests that the

introduced cranes have bred successfully on several occasions and regularly foraged in the paddy landscapes surrounding these wetland sites. The reintroduced population now exceeds 150 individuals across the three sites, and some individuals have dispersed to other sites in Buri Ram (Li et al. 2023).

Table 1. List of migratory species (based on the EAAFP list of species) with globally significant congregations in Sanam Bin Non-hunting Area.

Scientific name	IUCN	Average count	CSR1	CSR1 score
Sarus Crane *Antigone antigone*	VU	5	2	2.5

Count data from the 2017 and 2018 Asian Waterbird Census (AWC) was averaged in the RFI analysis for Sanam Bin Reservoir and then compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. Sarus Crane was found to regularly exceed the 1% population estimate during these two years, and the CSR1 score for this species provided the overall site score (Table 1). Sanam Bin Reservoir was also found to support large numbers of the Painted Stork *Mycteria leucocephala* and Asian Openbill *Anastomus oscitans* during the monsoon season, although none exceeding regional thresholds.

3.3. Other notable biodiversity

The site supports small numbers of Yellow-breasted Bunting *Emberiza aureola* (CR) during the winter period, and small numbers of several migratory birds-of-prey, notably the Greater Spotted Eagle *Clanga clanga* (VU). Sanam Bin is one of few wetland sites where populations of native apple snails *Pila* sp. continue to persist; most sites across Thailand have been invaded by the golden apple snail *Pomacea canaliculata* (Pradabphetrat et al. 2017)

4. Ecosystem services

4.1. Ecosystem services provided by Sanam Bin Reservoir

Sanam Bin Reservoir overlaps with diverse habitats, offering essential provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop[1] highlight 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 within the site. Fresh water has remained unchanged in the past but is expected to increase in the future, indicating its growing importance. Conversely, food provision has shown no change historically but is projected to decrease in the future, raising concerns about future resource availability. Regulating services, such as flood hazard regulation, primarily benefit communities within the site. This service has remained stable in the past but is anticipated to increase in the future, reinforcing its role in environmental management. Cultural services, including recreation ecotourism and knowledge systems and education, benefit communities within and distant from the site. Both services have shown no change in the past but are projected to increase in the future, underscoring the reservoir's importance for both local cultural activities and educational opportunities.

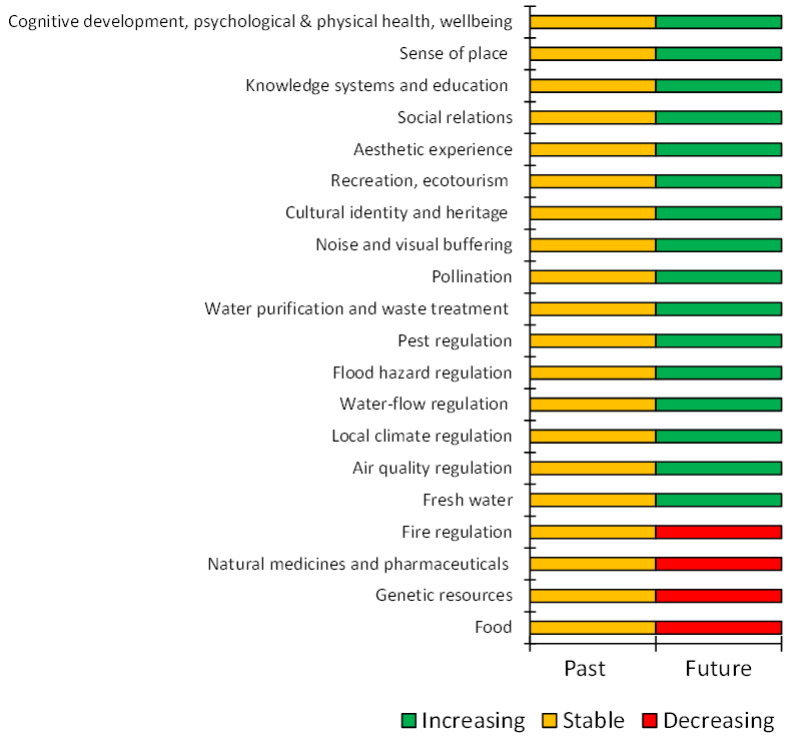

Figure 2. List of ecosystem services provided by Sanam Bin Reservoir, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

[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

Table 2. List of top ecosystem services provided by Sanam Bin Reservoir.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
Provision services						
Fresh water	Yes	✓			No change	Increase
Food	Yes	✓			No change	Decrease
Regulating services						
Flood hazard regulation	Yes	✓			No change	Increase
Cultural services						
Recreation, ecotourism	Yes			✓	No change	Increase
Knowledge systems and education	Yes	✓			No change	Increase

4.2. Flood mitigation services

The flood mitigation services provided by Sanam Bin Reservoir 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 and the average of all other inland wetlands in Thailand (Table A2 in Annex 1), Sanam Bin Reservoir shows some partly mixed results in terms of benefits and beneficiaries:

(1) for the average green storage capacity per sq. km of wetland, Sanam Bin Reservoir is consistently above average (356 Giga Litres or GL of water per km2 vs. 226 GL/km^2 for RFI inland sites and 216 GL/km^2 for all other inland wetlands);

(2) for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Sanam Bin Reservoir is consistently below average (81 vs. 251 people/km^2 RFI inland sites and 202 people/km^2 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, Sanam Bin Reservoir is again consistently below average (3.38 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 Sanam Bin Reservoir

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop[2] identified several drivers of change impacting Sanam Bin. High-impact drivers include housing and settlement developments, which significantly alter the natural landscape and contribute to habitat fragmentation (Table 3). Tourism and recreation infrastructure also poses a substantial threat to the wetland's ecological integrity.

Medium-impact drivers involve activities of site managers that moderately modify the site. Other medium-impact factors include droughts, fishing, killing and harvesting of aquatic resources, livestock farming and grazing, and restoration for conservation. Additionally, annual and perennial non-timber crop production contributes to the moderate-level impact on the site's natural habitat and biodiversity.

[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

Table 3. Drivers of change and their potential impact on the integrity of Sanam Bin Reservoir based on consultations with stakeholders.

Driver of change	Impact
Housing and settlement	High
Tourism and recreation infrastructure	
Activities of site managers	Medium
Droughts	
Fishing, killing and harvesting of aquatic resources	
Livestock farming and grazing	
Restoration for conservation	
Annual and perennial non-timber crop production	Low
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	
Energy generation, including from hydropower dams, wind farms and solar panels	
Excess energy	
Excess ponding of water onsite	
Fire and fire suppression	
Garbage and solid waste	
Habitat clearing	
Habitat shifting and alteration	
Household sewage and urban wastewater from outside the wetland site	
Hunting, killing and collecting of terrestrial animals	
Increased fragmentation within the wetland site	
Invasive animal species	
Invasive plant species	
Isolation from other natural habitats	
Loss of cultural links, traditional knowledge and/or management practices	
Loss of keystone species	
Marine and freshwater aquaculture	
Natural deterioration of important cultural wetland site values	
Other 'edge effects' that degrade the wetland site values	
Pathogens	
Recreational activities and tourism	
Research, education and other work-related activities	
Roads and railroads	
Sewage and wastewater from wetland site facilities	
Shipping lanes and canals	
Temperature extremes	
Utility and service lines	
Water extraction/diversion within the wetland site or catchment	

5.2. Potential alternative state of Sanam Bin Reservoir under current drivers of change

Stakeholders at the RFI workshop[3] 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 3). The alternative state of the site assumes there

[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

will be no changes in the current drivers of change impacting the site, and the current management regime.

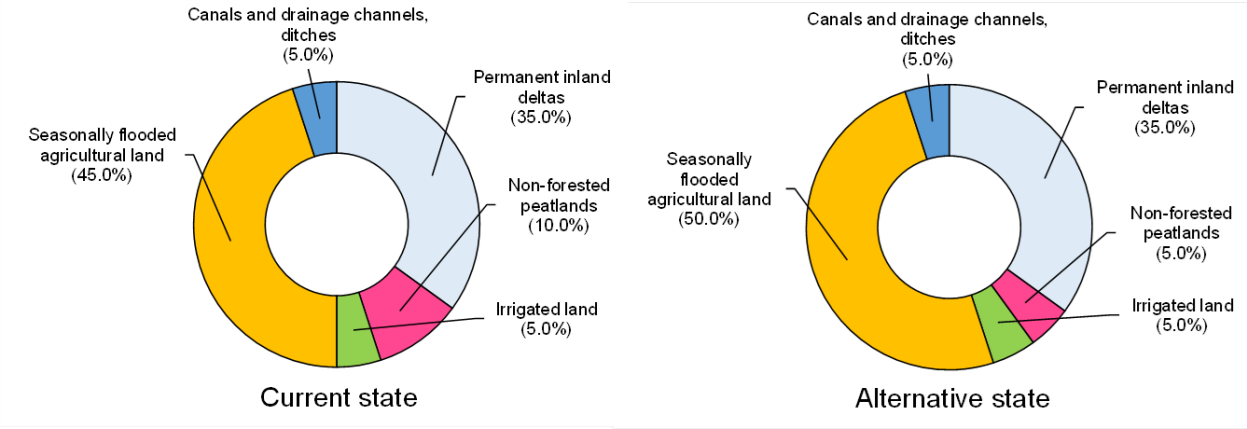

Figure 3. The proportional change in the extent of different habitat types between the current and alternative states of Sanam Bin Reservoir.

5.3. Expected changes in the ecosystem services of Sanam Bin Reservoir

Stakeholders at the RFI workshop[4] documented the future trends in the provision of ecosystem services in Sanam Bin Reservoir, 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.

Sanam Bin Reservoir overlaps with diverse wetland habitats, and therefore offers several essential provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop[5] 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 within the site. Fresh water has remained unchanged in the past but is expected to increase in the future, indicating its growing importance. Conversely, food provision has shown no change historically but is projected to decrease in the future, raising concerns about future resource availability. Regulating services, such as flood hazard regulation, primarily benefit communities within the site. This

[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

[5] 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

service has remained stable in the past but is anticipated to increase in the future, reinforcing its role in environmental management. Cultural services, including recreation ecotourism and knowledge systems and education, benefit communities within and distant from the site. Both services have shown no change in the past but are projected to increase in the future, underscoring the reservoir's importance for both local cultural activities and educational opportunities.

While the total area of green water habitats remains unchanged, the conversion of 30.0 hectares of non-forested peatlands to seasonally flooded agricultural land (Table A5) is expected to reduce green storage capacity by roughly 9.1% or 32.4 Giga Litres per km². This reduction reflects the lower water retention potential of agricultural land compared to high-value peatlands. Consequently, despite the stable habitat area, this functional loss may amount to nearly 7.4 people and 0.31 hectares of built-up areas losing flood mitigation benefits per km² of wetland.

6. Capacity needs in Sanam Bin Reservoir

Stakeholder consultations and analyses with government and civil society identified at least three stakeholder groups with clear roles in the long-term sustainable management of the Sanam Bin Reservoir. Table 4 summarizes the current and potential roles of these stakeholder groups in managing the Sanam Bin Reservoir. There are opportunities to strengthen knowledge of tourism and water quality monitoring, as well as others to be identified by local stakeholders.

Table 4. Capacity needs for the management of Sanam Bin Non-hunting Area, 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.)
Government: Department of National Parks, Wildlife and Plant Conservation (DWNP)	Conserve, restore, protect, and maintain site.	Support and manage the expansion of tourism (and levies)	Management and oversight for: Nature-based tourism (e.g. for Sarus Crane) Agriculture (e.g. organic rice	Improve facilities for tourism. Training to improve the water basin quantity/quality monitoring system.	Provide training for the communities/ and educational bodies in the proximity. RPR Ambassador programme.
Government: Department of Fisheries	Fish stocking of reservoir (for local	Continued work to stock fish in the reservoirs.			

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.)
	communities)		production)		Training programmes and workshops on nature-based tourism, and storytelling.
Government: Royal Irrigation Department (RID)	Management water storage. (too little water may cause ecosystem degradation)	Undertake expansion and dredging works to expand water storage capacity. Stronger management of water supply in the area of irrigated land.			
Government: Provincial Waterworks Authority.	Clean water production.	Improve management on water production, and supply of water to surrounding communities	-	-	-
Local communities (end users)	Support organic farming. Unrestrained use of water supply.	Work to reduce the use of agro chemicals to address water pollution. Work with stakeholders to improve guidelines for water use.	-	-	-
Zoological Park Organization of Thailand (ZPOT).	Sarus crane conservation and breeding program.	No change	-	-	-

7. Opportunities for RFI interventions

7.1. Recommended Interventions

Sanam Bin is an artificial wetland (much of it is an impoundment) created by the damming of a natural marshy area and is fed by many small watercourses which transect the River Mun floodplain, on the Mekong watershed. The main outflow is via small canals that have been constructed for irrigation and are also an important source of water for household use in Prakhon Chai District. Sanam Bin Reservoir is one of two sites chosen for programme to reintroduce the highly threatened eastern population of Sarus Crane into Thailand (see Li et al. 2023). The reservoir was declared as a Non-Hunting Area in 1980, with an area station established at the site with a guard, but despite this protection parts of the site have been encroached upon by local people for housing and cultivation of crops, there has been some illegal hunting and incidental disturbance of the water birds by fishermen, and there are problems with invasive species. To improve conservation and management of Sanam Bin Reservoir, there is a need for: (1) Strengthening legal protection and management of Sanam Bin Reservoir; (2) Continuation of study and monitoring of the Sarus Crane population and raising awareness of the cranes and wetland ecosystems; and (3) Strengthening invasive species management with a focus on giant mimosa *Mimosa pigra* and water hyacinth *Pontederia crassipes*.

Sanam Bin Reservoir is a tourist attraction, including for ecotourism focussed on the introduced Sarus Cranes. The ecotourism activities there are projected to increase in the future, reinforcing Sanam Bin Reservoir's importance as a resource for local people and visiting tourists, including through (1) Improvement of ecotourism infrastructure at Sanam Bin Reservoir, 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 activities in the areas surrounding Sanam Bin Reservoir are rice cultivation, with the rice paddies irrigated with water from the lake, and fishing and keeping of domestic ducks. 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 Sanam Bin Reservoir, and fisheries in the reservoir, using wildlife-friendly approaches; and (2) Improved management of agro-chemical waste in the rice paddies around Sanam Bin Reservoir. Organic rice farming has expanded substantially in the landscape around Huai Chorakhe Mak (in Sakae Prong *tambon* since the early 2000s) and was subsequently rebranded to Sarus Rice and currently sells for 2.4 USD per kg (higher than regular jasmine rice) (Li et al. 2023) and has received considerable support from the local community there. There are therefore excellent opportunities to apply lessons from Sake Prong in Sanam Bin, to expand organic (or Crane Rice) production here.

Table 5. Summary of key RFI interventions proposed for Sanam Bin Non-hunting Area

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Component 1. Strengthening site management and protection of Sanam Bin Non-hunting Area.					
Conduct a scoping study of existing interventions and threats and disturbance at Sanam Bin, including targeted work on long-term threats (from climate change and invasive species management).	Best practices, guidelines, and standards for proposed RFI interventions	Assessment report with key threats identified and recommendations for improved management published and disseminated to key stakeholders. Number of consultations conducted with local stakeholders for a participatory process in conducting the scoping study. Number of stakeholder groups engaged in the scoping study.	30,000	1 year	DWNP and management board of NHA Buri Ram provincial government Prakhon Chai *tambon* and district governments Consultancy companies Conservation organisations Research organisations (e.g. Mahidol and Khon Kaen universities)
Strengthen and expand site management and zonation of the Sanam Bin landscape (including the NHA and surrounding landscapes). Conduct exchange visits to Sakae Prong subdistrict.	Improved site management for Sanam Bin through site and zonation management plans and co-management. Establishment of a co-management framework, with stronger involvement of local stakeholders.	Site management plan and zonation plan over short- to medium-term for Sanam Bin developed, agreed by key stakeholders and endorsed by the management authority (Sanam Bin NHA). A co-management framework, with stronger involvement of local stakeholders, developed. Number of stakeholder groups engaged in the management planning.	50,000	2 years	DWNP and management board of NHA Buri Ram provincial government Prakhon Chai *tambon* and district governments ZPOT BCST and local conservation groups

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of consultations conducted with local stakeholders for a participatory process in the management planning. Number of activities in the site management, zonation, and co-management plans implemented.			
Strengthen management of site fisheries in Sanam Bin reservoir, with a focus on small-scale artisanal fishers.	Fishing activities in the reservoirs better managed and conserved. Improved site management through the shift to sustainable fishing practices and increased participation of fisherfolks	Licensing framework for fishers established. Number of consultations conducted in the development of the licensing framework, ensuring a participatory process. Number of local fishers from local communities engaged in the good practices in the use of nets.	100,000	3 years	Department of Water Resources Department of Fisheries DWNP Prakhon Chai *tambon* and district governments Conservation organisations
Strengthen the invasive species management with a focus on water hyacinth, apple snails and giant mimosa in Sanam Bin and surrounding rice farming land	Improved site management and biodiversity conservation through an effective invasive species management for the water hyacinth, apple snails, Giant Mimosa in Sanam Bin.	Area (target of at least 20 has of wetlands) with controlled management of the invasive species including Giant Mimosa An invasive species monitoring plan developed, consulted with key stakeholders and implemented by NHA management.	100,000	5 years	DWNP and management board of NHA Buri Ram provincial government Prakhon Chai *tambon* and district governments

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of experimental plot (target of at least 1) for Mimosa removal. Number of consultations conducted in the development of the invasive species monitoring plan, ensuring a participatory process Number of identified activities in the invasive species monitoring plan implemented. Number of people engaged in invasive species management.			Research institutions (Khon Kaen University)
Component 2. Stronger wildlife protection and monitoring, with a focus on the Sarus Crane.					
Strengthen the legal protection of Sanam Bin Non-hunting Area (NHA)	Improved wetland protection through higher level of legal status for Sanam Bin Non-hunting Area, with boundaries of the protected area precisely delineated, co-management, and increased patrol and enforcement efforts for wildlife	Number of local and/or international designation facilitated for Sanam Bin NHA Number of activities implemented to advocate for a higher legal status for Sanam Bin NHA A co-management framework, with patrol and enforcement, co-development with key stakeholders.	100,000	3 years	DWNP and management board of NHA Buri Ram provincial government Prakhon Chai *tambon* and district governments ZPOT

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	protection and encroachment activities	Number of patrol and enforcement activities focused on encroachment and using SMART approaches implemented. Number of consultations conducted for the co-management framework development.			Nakhon Ratchasima (Korat) Zoo Conservation and academic organisations (including bird and community-focused NGOs)
Strengthen biodiversity monitoring, with a focus on the reintroduced Sarus Crane population.	Improved biodiversity conservation through increased awareness of Sarus Crane and wetland conservation amongst local people and tourists, and biodiversity monitoring	Number of awareness activities on importance of preserving the cranes and the wetlands implemented. Number of stakeholder groups engaged in the awareness-raising and biodiversity monitoring activities. A biodiversity monitoring program is developed and implemented. Number of people engaged in biodiversity monitoring. A biodiversity monitoring group established.	50,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Component 3. Upscaling tourism infrastructure and strengthening sustainable ecotourism in Sanam Bin					
Improve and expand tourism infrastructure at Sanam Bin, including signages and viewing structures	Improved site management and protected through nature-based tourism benefits, increased capacity of local stakeholders on nature-based tourism, and enhanced appreciation for Sarus Cranes, migratory waterbirds, and wetland habitats.	Number of nature-based tourism infrastructure (i.e. signage and viewing structures) established and improved. Number of people benefitting from nature-based tourism activities.	250,000	2 years	LGUs Department of National Parks, Wildlife and Plant Conservation Nakhon Ratchasima (Korat) Zoo Conservation and academic organisations (including bird and community-focused NGOs)
Strengthen the capacity of local communities and businesses for nature-based tourism.		A nature-based tourism strategy with a focus on Sarus Crane developed and implemented with local tourist operators and communities. Number of business plans and packages co-developed with local stakeholders for nature-based tourism. Number of stakeholder groups engaged in the development of the business plans, packages, and nature-based tourism strategy. Number of consultations conducted with key stakeholders in the development of nature-based tourism strategy and business	200,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		plans, ensuring a participatory process. Training programme established for nature-based tourism Number of training activities implemented to target participants Number of people trained (target of 20 target operators) from target participants.			
Component 4. Scaling up organic rice farming (or 'Crane Rice') in Sanam Bin					
Scale up sustainable, regenerative rice-farming in the rice farming landscape that surround Sanam Bin, using organic approaches. Conduct exchange visits to Sakae Prong on organic rice farming.	Improved site management through the practice of organic and biodiversity-friendly rice farming in landscapes around Sanam Bin NHA, and financing mechanism support and incentive for biodiversity – friendly farming practices.	Percentage (target of 30%) of rice fields around Sanam Bin NHA under organic/ biodiversity-friendly cultivation. Number of rice farmers shifting to biodiversity-friendly farming as a source of local livelihood (target of 50% increase compared to the baselines) A capacity building (and training) program for organic and biodiversity-friendly rice farming and financial management developed and implemented. Number of capacity-building activities	500,000	10 years	Ministry of Agriculture and Cooperatives DWR Buri Ram provincial government Prakhon Chai *tambon* and district governments Conservation organisations (including bird and community-focused NGOs) Agricultural banks

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		conducted for target participants. Number of people trained on biodiversity-friend farming and financial management in target stakeholders. A financing mechanism (for local loans and grants) created for local communities and supported by key lending institutions for farmers. Number of farmers benefitting from the established financing mechanism			
Improve the management of agro-chemical waste in the rice paddies around Sanam Bin	Improved site management and biodiversity conservation through the reduction of agrochemical waste inflow into the wetlands	Agro-chemical management and disposal protocols established and strengthened for all relevant *tambons*. Number of stakeholder groups engaged in the development of the agrochemical management and disposal protocols. Number of people engaged in monitoring agrochemical waste inflow in the rice paddies around Sanam Bin	500,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Baseline metrics for measuring agrochemical flows established. Monitoring data shows reduced inflow of agro-chemicals into Sanam Bin against baselines, using established metrics.			
Total investment for 10 years			**USD 8,980,000**		

7.2. Potential Financing

The estimated project cost is USD 8,980,000 over 10 years. This budget supports the development of site management and a co-management framework, agrochemical waste management for rice paddies around Sanam Bin, sustainable fishing practices, invasive species management, increased legal protection for the Sanam Bin through local and/or international designations, nature-based tourism infrastructure, establishment of a financing mechanism, and capacity-building for local stakeholders on biodiversity monitoring, patrolling, enforcement, nature-based tourism, and financial management. Table 5 summarizes the projected budget distribution across the proposed project components.

7.3. Proposed Institutional Arrangement

The proposed project is expected to be implemented over a period of ten years, with main project components focusing on improved site management for Sanam Bin Non-hunting areas (led by the Department of National Parks, Department of Water Resources) and expanding organic and/or biodiversity-friendly rice agriculture (with the Ministry of Agriculture and Cooperatives).

7.4. Project Beneficiaries

This proposed project is expected to undertake activities promoting gender inclusion and participation in livelihood activities, through capacity building activities for organic or 'Crane Rice' rice farming, agriculture, and nature-based tourism (including wildlife-watching and agri-tourism).

There are no indigenous communities in the project landscape.

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.

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 Sanam Bin, 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 Sanam Bin reservoir 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)	300 – 412
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km2)	69 – 94
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km2)	2.85 – 3.91

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 Sanam Bin Non-hunting Area 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	210.5	35.0	210.5	35.0
Non-forested peatlands	60.1	10.0	30.1	5.0
Irrigated land	30.1	5.0	30.1	5.0
Seasonally flooded agricultural land	270.6	45.0	300.7	50.0
Canals and drainage channels, ditches	30.1	5.0	30.1	5.0
Total	601.4	100.0	601.4	100.0