

An aerial photograph of a lake restoration project. The image shows a large body of water with several small, green islands and peninsulas. Winding paths or levees connect these landmasses, creating a complex network of water and land. The vegetation is lush and green, with some areas showing purple flowers. Numerous white birds, likely egrets or herons, are seen flying over the water and standing on the land. In the top left corner, a white bird is perched on a green leaf. The overall scene depicts a thriving, restored ecosystem.

Lake Rejuvenation for Birds

From a mud dump site to a valuable habitat:
The ecological restoration project at
Luoma Lake, Xinyi, China

Project Statement

Lake Rejuvenation for Birds

—From a mud dump site to a valuable habitat:

The ecological restoration project at Luoma Lake, Xinyi, China

Based on the "Returning Polder Area to Lake" Program for Luoma Lake, this project aims to restore the ecological balance between the mud dump site and the shoreline of Luoma Lake. The initiative focuses on creating a wildlife habitat, with the goal of encouraging birds that once lived here to return.

To achieve this, **the project focuses on reshaping the ecological landscape through water system connectivity, earthwork balance, and tree transplantation, with an emphasis on establishing a bird sanctuary.** As it transforms the mud dump site into a bird-friendly habitat, the project also reserves space for future development, ensuring the coexistence of human activities and natural habitats. So far, the project has restored 8.28 square kilometers of wetland along a 19.51-kilometer stretch of the shoreline.

The project not only raises ecological awareness within the local community but also significantly promotes local biodiversity.

By collaborating with the government, it aids in planning and constructing a resilient ecosystem where people and birds can coexist harmoniously. This approach is grounded in scientific principles and focuses on natural methods of ecological restoration.



Project Narrative and Contents

I. Background

Located in Xuzhou City, Jiangsu Province, China and spanning between Xinyi and Suqian, Luoma Lake is not only the fourth largest freshwater lake in Jiangsu Province, but also a key impounded lake as well as a hub for the South-to-North Water Diversion Project. It is an essential water source in northern Jiangsu and a vital stopover site for migratory birds. Luoma Lake plays an important role in supplying water, preventing floods and maintaining ecological balance throughout its reaches.

There was a time when distributions of aquatic plants accounted for more than 50% of the lake area with a large reedbed stretching out to attract various kinds of birds to roost, among them Oriental Stork, a national treasure, was spotted from time to time. However, since the 1990s, human activities such as pond-based farming, reclamation, fishing, and illegal sand mining have led to the shrinkage in surface area, loss in flood control and water storage capacity, damage to the shoreline, wetland degradation in terms of ecosystem functions and a sharp decline in biodiversity. In 2019, a large-scale “Returning Polder Area to Lake” program was implemented. Despite an increase in lake area, the littoral zone suitable for aquatic plants has reduced, leading to habitat loss for birds. There is an urgent need for ecosystem protection and restoration at Luoma Lake.

The Chinese government has been promoting the Shanshui Initiative under a policy for restoring natural spaces, i.e., mountains, rivers, forests, farmlands, lakes, grasslands and deserts. As part of the Initiative, the ecological restoration project at Luoma Lake (Xinyi) aims to provide a restoration solution for the lakefront and the mud slump site resulting from the “Returning Polder Area to Lake” Program.

II. Status

The site covers the shallow bodies of water of Luoma Lake in Xinyi with an average water depth of 3.32 meters. The east dike is 23 kilometers long, west dike 9 kilometers long, and north dike 6 kilometers long. The surrounding area comprises mainly farmland and villages. The “Returning Polder Area to Lake” Program has resulted 6 mud dump sites covering an area of 9.31 square kilometers. The project is expected to restore a total wetland area of approx. 8.28 square kilometers along a 19.51-kilometer shoreline.

The site survey shows damages in some parts of the natural shoreline, pollutants in the surrounding areas, NPS pollution resulting from land runoff, accumulating mass of waste by the lake shore, poor water environment and slight eutrophication over years. All this poses a threat to the natural landscape, water safety and quality and the entire water ecosystem.



Project Narrative and Contents

III. Challenges

The local government has used a single-species plantation for ecological restoration. However, it is impossible to create a healthy ecosystem in such an unsophisticated way. **The problem lies in guiding decision makers to protect and restore the ecosystem in habitats properly.** As extreme weather becomes more frequent, the water conservancy department has put forward flood control requirements for the lake area, which poses a challenge in designing the project. The local government has also explained their needs in relation to human activities. The real question is how to achieve coexistence among humans, animals and plants in the ecological environments.

IV. Vision and Strategy

In view of the conditions discussed above, the project vision is defined as **Lake Rejuvenation for Birds**. **We are confident that the rejuvenation of Luoma Lake is possible through ecological restoration.** Therefore, we have proposed three strategic steps as follows:

1. For **the sake of flood safety**, introduce the water system along the downstream flow paths, create a tidal flat wetland system through cut and fill excavation without reducing the storage capacity, and transplant trees;

2. Restore the ecosystem by **creating a habitat that supports diversity patterns for the habitat** preferences of various kinds of birds;

3. **Prepare the ecological matrix for ecotourism** and use an island-like system to separate human activities from bird habitat.

V. Approachs

1.Modification of Mud Dump Sites

Island No.1 – The Island No.1 is planned to be an ecotourism hub. The perimeter dikes of fishponds will largely remain in place, only **partially removed to expand water flow and connect the ponds**. An open lake will be created in the center, the habitat for benthic fish will be restored and industrial crops will be grown in the wetland.

Island No.3 – The Island No.3 is planned to be a bird island in the middle of the lake. **The water system will be introduced along the downstream flow paths to create the water area surrounded by woodlands, grasslands and reedbeds to provide a habitat for birds and other associated species.** Human activities will be restricted, and an abandoned schoolyard will serve as a bird watching station.

Island No.5 – The Island No.5 is planned to be a country park for **public recreation and nature education**. The existing water channels will be connected into a network. Buffer zones will be provided to minimize human impact. A birding trail and other amenities are being planned.

Project Narrative and Contents

Remediation area – The remediation area will undergo a minor modification, including reinforcing the upstream face and the outer revetment of the islands, adding nectar and berry shrubs and trees to enrich the habitat system.

2. Modification of Revetment

To create the habitat, a minor modification that involves **creating gentle slopes and planting willow cuttings** is used wherever possible; for the revetment zone with severe wind and wave erosion, a moderate modification **using riprap revetment and Chinese fir piles** is needed; when necessary, a extensive modification for key locations involves the use of **gabion revetment to reinforce**.

3. Planting Plan

The basic-tone tree species, main tree species and hygrophytic plants are selected from **native plants and bird-friendly plants** and bird perches are added to create **quasi-natural artificial plant communities** for bird habitat. The arrangement of different plant species is based on the water level. Given the habitat characteristics of different birds, a multilayer structure of plant species is carefully formed to **create habitats for birds and other wild animals** and restore the composition of biological community and **the ecological functions of the wetland ecosystem**.

4. Structural Design and Material Selection

A number of **small birdwatching huts** will be provided to meet the needs of birdwatcher and the requirements of flood control and ensure the floodway is not affected. The interpretation system for wetland habitat will be improved along the **nature education trail**. **Natural, simple, low-carbon and eco-friendly materials will be used**.



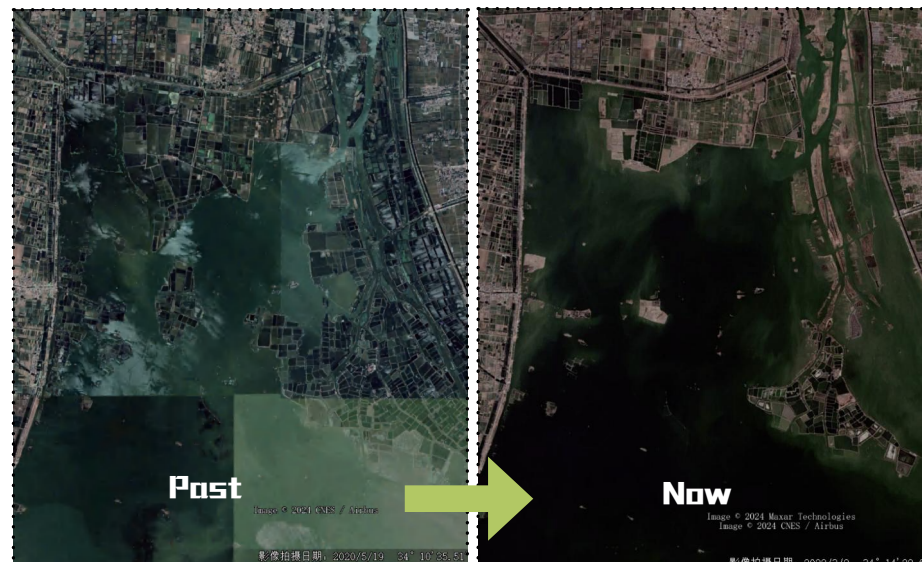
CATALOGUE

- Status
- Challenges
- Strategy
- Approachs



Status

Site Condition



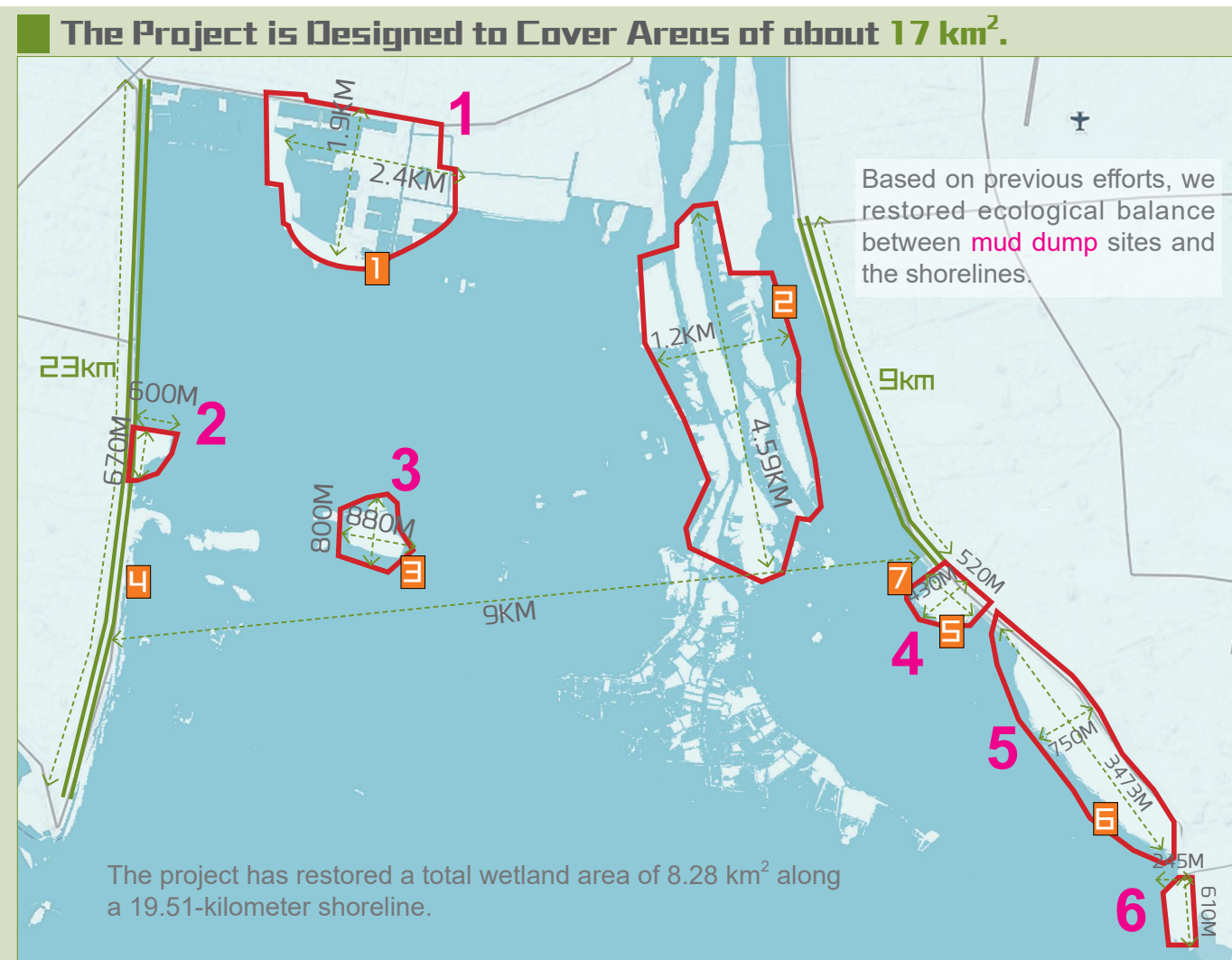
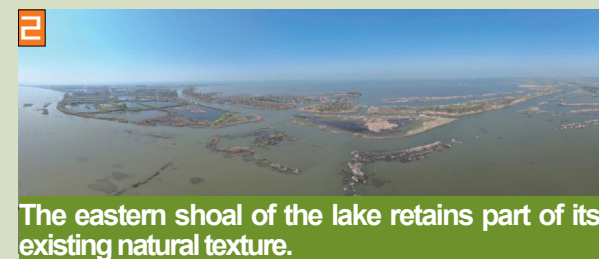
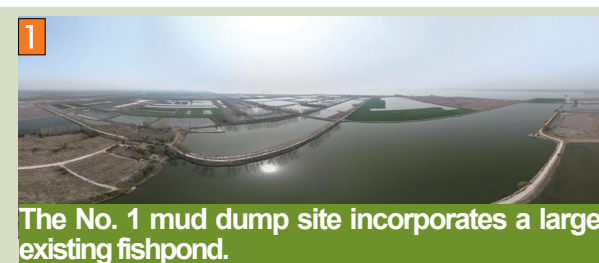
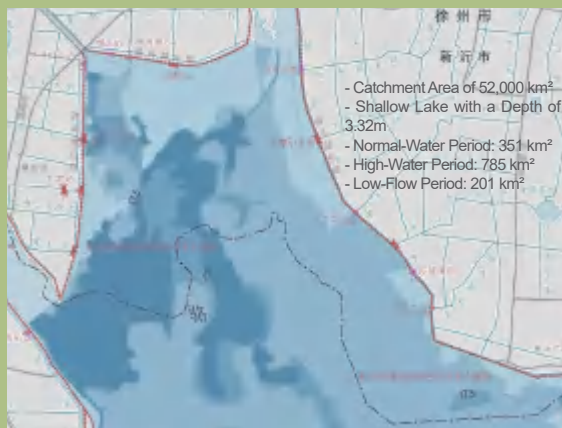
After the return of polder areas, six mud dump sites have been put in place, ranging from 0.175 km² to 1.826 km², with the northeastern part intact.

According to on-Site Investigation,

- Shorelines and beaches suffered from erosion and pollution.
- Surface runoff carried pollutants into the lake, worsening water quality.
- Luoma Lake experienced mild eutrophication over time.
- Threats to natural landscape, water quality, and ecosystem function.

Luoma Lake

- Key Water Source for South to North Water Diversion Project.
- Essential Water Source for Xuzhou City.
- Drinking Water Protection Area for Suqian and Xinyi Cities.
- Irrigation Water for 400 km² of Arable Land in Xinyi City.
- Water Supply for Industries and Families in Neighboring Cities.



Status

Bird Resources



Habitats of Different Protection Targets

Name	Latin Name	Preferred habitat	Bird type	Preferred food
Red-crowned crane	<i>Grus japonensis</i>	They live in pairs or in flocks in open plains, marshes, lakes and near tidal flats. They are vigilant.	Migratory bird	Mainly fishes, prawns, insects, mollusks and plant leaves and stems.
Oriental white stork	<i>Ciconia boyciana</i>	They live in open and remote plains, grassland, marshes, rivers, lakes, ponds and wetlands with sparsely grown trees and paddy fields far away from human settlement.	Migratory bird	Mainly fishes, frogs, mollusks and small amount of leaves.
Great bustard	<i>Otis tarda</i>	Open plains, dry and wet grassland near lake shores.	Migratory birds	Frogs, insects and leaves.
Northern harrier	<i>Circus cyaneus</i>	They live in open ground such as plain lakes, marshes, river valleys, marshes and reed fields, and will move to paddy fields, grass slopes and open forest.	Migratory bird	Small birds, mice, frogs, lizards and big insects.
Chinese egret	<i>Egretta alba</i>	They live in small or big flocks in rivers, lakes, brooks, paddy fields and marshes in coastal areas.	Resident bird	Small fishes, prawns, crabs, tadpoles and aquatic insects etc.
White spoonbill	<i>Platalea leucorhynchos</i>	They live in shallow waters along the shores of rivers, lakes, flooded plains, reed swamps and mangroves, but not in shores with riprap in river bottom and dense vegetation.	Mostly resident birds	Prawns, crabs, aquatic insects, mollusks and small amount of plants.
Whooper swan	<i>Cygnus cygnus</i>	In breeding season, they prefer to live in open shallow water area with abundant food, such as lakes and ponds rich in aquatic plants and sluggish rivers. In winter, they live in mainly grassy large lakes, reservoirs, rivers, beaches and open farm fields.	Migratory bird	Roots, leaves, stems and seeds of aquatic plants and mollusks.
Reed Parrotbill	<i>Parus dominicensis</i>	They live in small flocks in reeds and escape, sentry and sweet to send alarm.	Resident bird	Small insects and beetles moving slowly in, on the stems and on the leaves of reeds.
Swinhoe's snipe	<i>Gallinago swinhoei</i>	They live in open lakes, ponds, reed marshes and paddy fields and prefer prairie land and reeds as sanctuary.	Passing bird	Mainly insects, insect larvae, earthworm and shellfishes.
snaw	<i>Megascops alba</i>	They live in lakes, rivers, ponds and wetlands and breed in tree holes. They fear people very much and live with common poachers in autumn and winter.	Migratory bird	Beetles, semi-aquatic hemiptera, dorbeetles, small fishes and frogs.
Great egret	<i>Ardea alba</i>	They live in smaller big flocks in rivers, lakes, brooks, paddy fields and marshes in coastal areas.	Summer resident, partly passing birds	Orthoptera, coleoptera, diptera, beetles, aquatic insects, small fishes, tadpoles and lizards etc.
Moorhen	<i>Gallinula chloropus</i>	They usually live in lakes and ponds and on small floating and emerging aquatic plants. In water areas with trees or covered by emergent aquatic plants, they prefer waters areas that are not too open.	Migratory birds	Snails, mosquitoes, migratory locusts, crickets, beetles and stems, leaves and seeds of plants.
Spot-billed duck	<i>Anas zonorhynchos</i>	They live in small and big inland lakes, rivers, reservoirs, in wetlands and also appear in paddy fields during migration and wintering seasons. They usually live with other ducks.	Migratory bird	Stems, leaves, tender shoots, roots, floating algae, aquatic insects and mollusks.

Main Findings

- Luoma Lake was once home to various water birds (Pelecaniformes, Podicipediformes, Anatidae, Gruiformes, and Laridae).
- The vast reed ecosystem attracted Passeriformes birds.
- The "national treasure of birds" — the Oriental white stork, also frequently visited.
- However, destructive fishing activities have led to a decline in bird population.

Challenges and Opportunities

1 Single Approach Hindered Scientific Ecological Restoration

The local government decided to plant only one species of tree for ecological restoration. However, this simplistic approach cannot foster a healthy ecosystem. Shoreside trees, vulnerable to being knocked down by wind and waves, fail to attract birds and other wildlife. Therefore, the challenge of how to protect and restore the habitat ecosystem effectively remains unresolved.

2 Flood Control Policy Restricted the Selection of Ecological Restoration Options

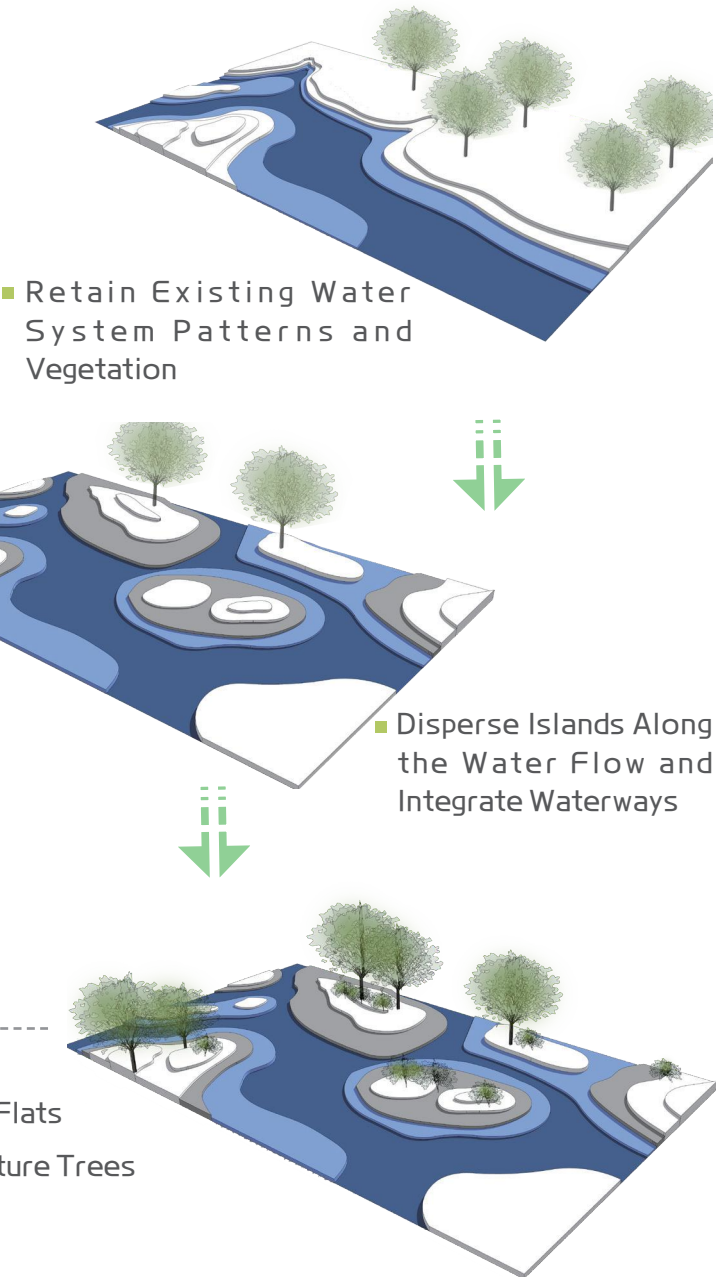
In recent years, frequent occurrences of extreme weather have prompted the water resources agency to prioritize flood control safety in the lake area. They have set forth explicit requirements: no additional earthwork in the lake area, ensuring no structures exceed a height of 24.5 meters, prohibiting tree planting, and preventing permanent structures that could impede flood diversion. While these requirements ensure safety for the local area, they also present significant challenges for design and planning.

3 The Vision of Coexistence Between Human and Nature

As joint users and beneficiaries of the ecological environment, the local government has proposed the vision to build a harmonious relationship between human and nature, aims to create a comprehensive system where humans, flora, and fauna can coexist harmoniously. It is a question, also the opportunity should be considered and promoted systematically.



Conceptual Diagram



Water System Connectivity

The existing mud dump site has turned into a landmass, obstructing the river’s natural flood flow. To address this, a new water system aligned with the river’s flow direction was established, to achieve water connectivity and transform it into a mudflat wetland ecosystem.

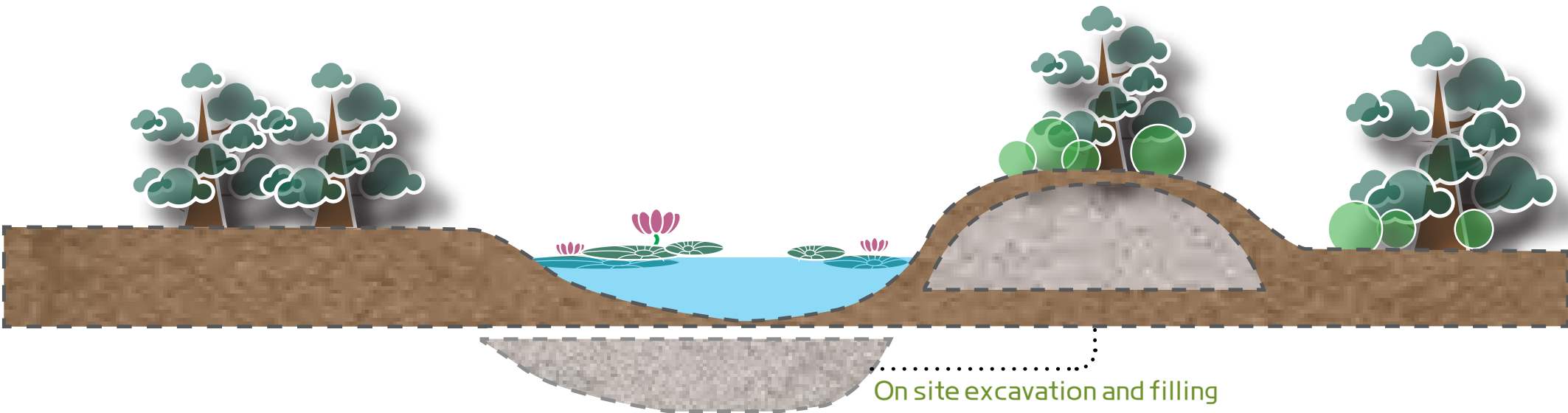


Strategy

1. Guarantee Flood Control Safety

Earthwork Balance

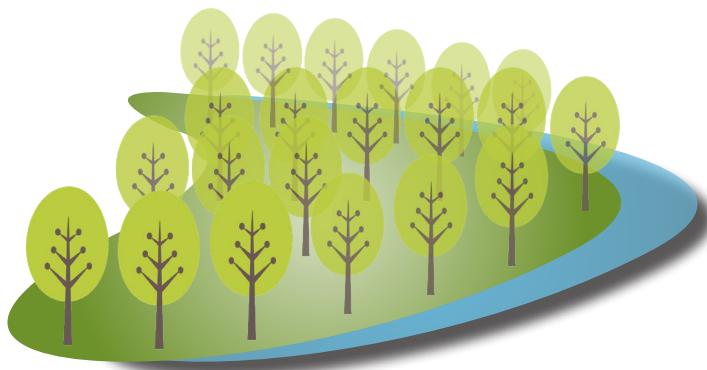
Due to the site constraints that prohibit moving earth offsite, the cut-and-fill approach was used to achieve earthwork balance, aligning with the site-based geographical conditions.



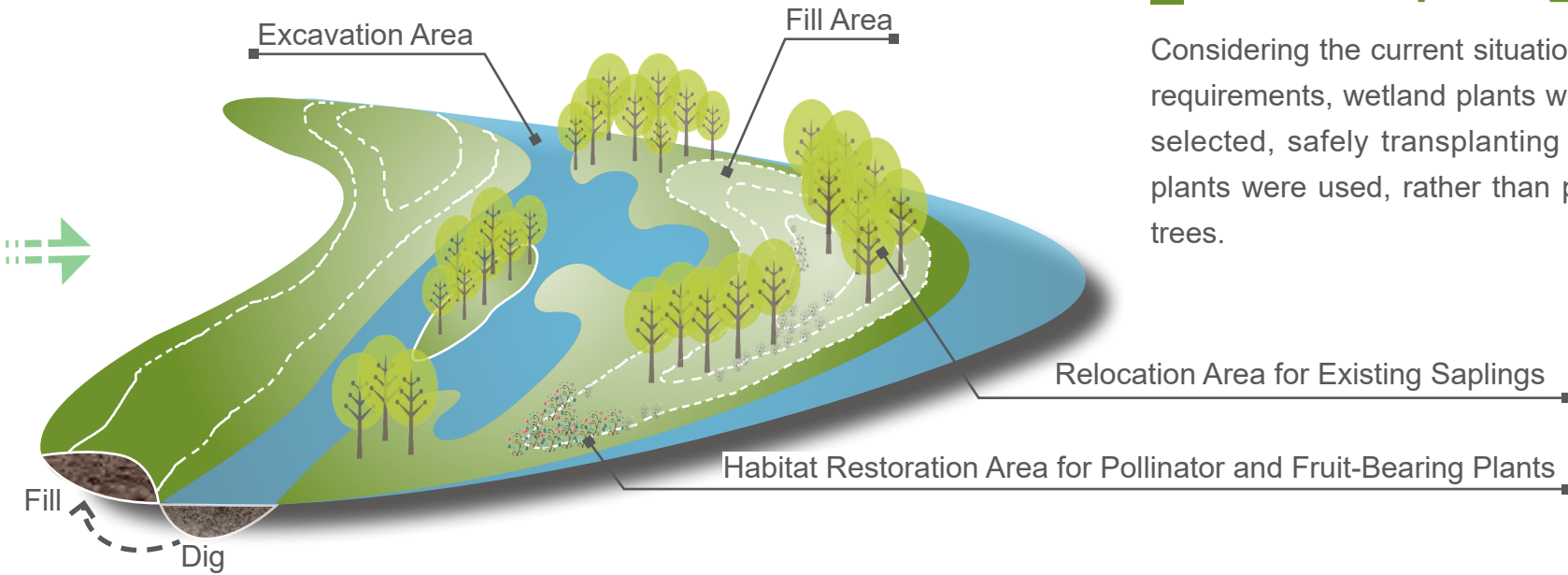
From a mud dump site to a valuable habitat:

Tree Transplanting

Considering the current situation and safety requirements, wetland plants were primarily selected, safely transplanting the existing plants were used, rather than planting new trees.



Existing Trees



Modification Model Diagram



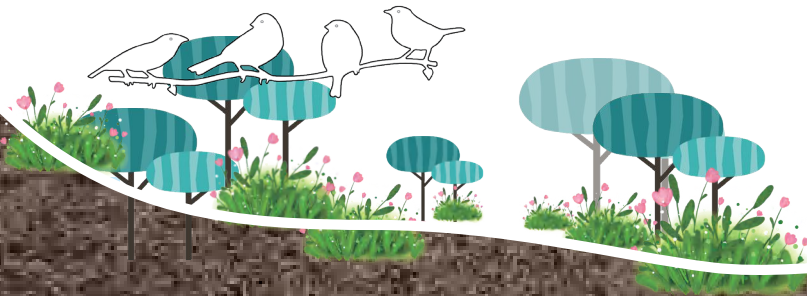
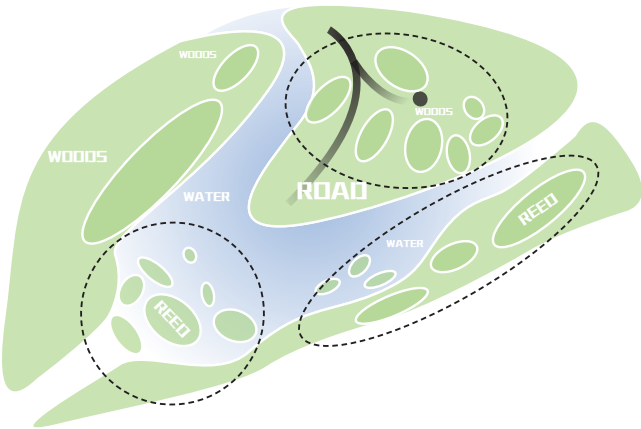
"Birds are the first to know whether the ecosystem is good or not."

Creating Habitat Patterns to Attract Birds

Shallow Water Area (5-10cm)	Medium-depth Water Area (10-50cm)	Deepwater Area (>50cm)
Width:5-100m	Width:30-100m	Width:>50m
Charadriiformes	Ciconiiformes, Gruiformes	Anseriformes, Lariformes
Charadriiformes: - Habitat: Lakes, river banks, swamps - Nests: Sand, sandstone, islets, sandbanks	Ciconiiformes: - Habitat: Swamps, paddy fields - Foraging: Shallow waters, open land - Nests: Tall trees, cliffs Gruiformes: - Habitat: Swamps, grasslands, prairies near water - Nests: Aquatic grass, ground	Anseriformes: - Habitat: Lakes, rivers, swamps, waters with abundant aquatic vegetation. - Nests: Built in reeds, cattail bushes in shallow water, or nearby grasslands. Lariformes: - Habitat: Lakes, swamps, wet meadows, islands surrounded by water. - Nests: Often in shallow caves or on the ground on islands in lakes or watersides.

1.The habitat pattern that attracts birds consists of a series of water modules surrounded by Woodlands, Grasslands, and Reeds.

2.At the land-water interface of each module, sandy and pebble beaches are formed. The constituent units interlock with each other and their edges are connected, presenting a mosaic pattern.



Gentle slopes
Wading Bird Ecosystem
Red-crowned crane, Oriental white stork,
White spoonbill, Swinhoe’s snipe, etc.

Open water
Swimming Bird Ecosystem
Whooper swan, Moorhen, Spot-billed duck, etc.

High nesting
Raptor Ecosystem
Northern harrier

Forest hinterland
Scansorial Birds Ecosystem



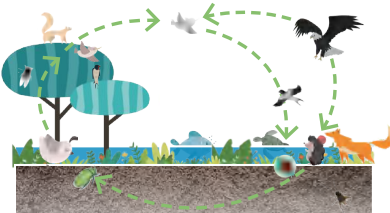
Analysis From a Regional Perspective



An interconnected corridor of creatures' habitat



An ecological space of waterways, farm fields and forest network



Wetland ecosystem rich in biodiversity

Analysis From a Site Perspective

Targets of protection: species and genetic resources of strong regional representativeness, high value and great significance of protection, as well as vegetation in land-lake ecotones.

These Birds Require Special Protection:



Red-crowned crane



Oriental white stork



Great bustard



Whooper swan



Northern harrier



Chinese egret



White spoonbill

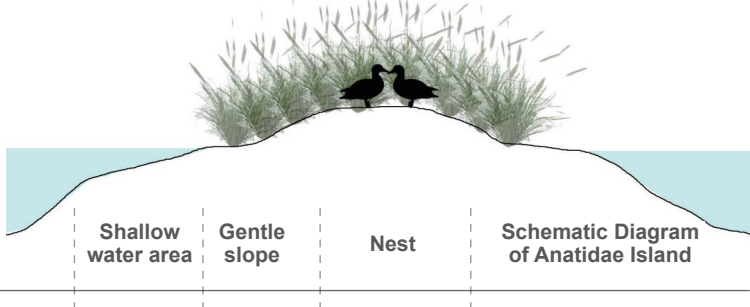


Smew

Anatidae Island

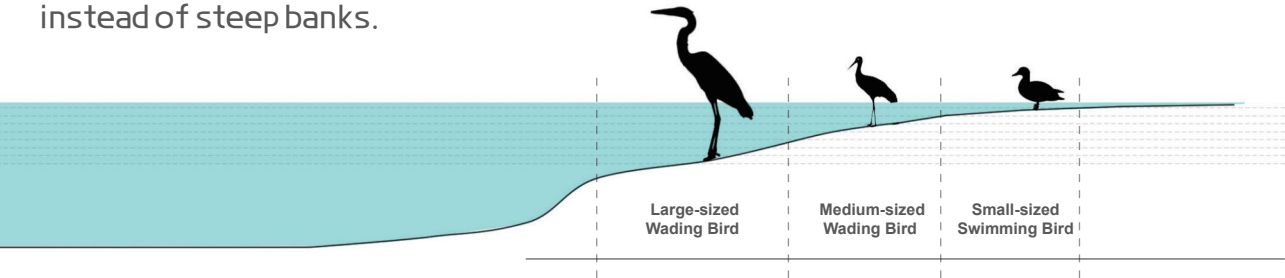
— Suitable for Local Breeding of Anseriformes Birds

- Island > 30m away from shore.
- Island radius > 5m.
- Gentle slopes around for easy movement and plant growth.
- Vegetation in shallow water areas covers nest for protection.



Tip1: Revetment for Wading Birds:

Natural edges with a slope gradient ranging from 1:4 to 1:15, instead of steep banks.



Tip2 : Habitats for Different Types of Protection Targets

- *Grus japonensis*, *Ciconia boyciana*, *Platalea leucorodia*, *Otis tarda*, *Gallinagomegala* prefer to live in shallow wetlands of lakes and shallow shore prairie land with abundant food, and are sensitive to humans;
- *Cygnus cygnus*, *Gallinula chloropus* and *Anas zonorhyncha* prefer open waters with abundant food;
- *Mergus albellus* prefer open waters and fear humans; *Paradoxornis heudei* prefer covert reeds;
- *Ardea alba* and *Egretta alba* live and eat in rivers, lakes, brooks and paddy fields.



3. - Ecological Conditions Should be Improved to Boost Eco-tourism in the Future.
- Through Division of Islands, Human Activities are Limited and Birds are Less Disturbed.



Vision: Lake Rejuvenation for Birds

Birds were once the enemy of fishermen who had to drive them away to make a living.

Birds were losing their habitats as a result of the human-wildlife conflict and moving away due to food shortage.

Birds are an indicator of the ecological environment in an area.

Nowadays, in view of the importance of the ecological environment, a “Returning Polder Area to Lake” Program is implemented to restore the habitats for birds and welcome them home.



- **- In the 1990s, polder embankment for farming gained traction.**

Pond-based farming, reclamation and fishing were very common in Luoma Lake and caused the degradation of watersheds and the loss of bird habitats:



- **- In 2017, bird population here plummeted**

The egrets and herons leaving earlier did not show up for more than a year. There were less than 100 birds staying on the bird island, where the bird population had once been more than 20,000.



- **- In 2018, the "Returning Polder Area to Lake" Program kicked off.**

The local government banned cage aquaculture and net enclosure culture to return polder area to lake and remove farm ponds:



- **- In 2021, a 10-year ban on fishing took effect to facilitate restoration;**



- **- In 2022, Luoma Lake became a project under the Shanshui Initiative**

The ecological restoration project at Luoma Lake (Xinyi) was included in the second batch of China's integrated protection and restoration projects for mountains, rivers, forests, farmlands, lakes, grasslands and deserts



- **- Today, habitat restoration is underway;**

We believe this project will rejuvenate Luoma Lake and regain its former glory in the near future.

Approaches

An Overview

Island No.1

An Ecotourism Hub

"Eco + specialties industries", fish, aquatic vegetables

Islands No.2

Under restoration with no visitors allowed

Island No.3

A Bird Island in the Middle of the Lake

Bird research and education

West Revetment Zone

A moderate modification is needed, using riprap revetment or gabion baskets for slope protection

East Revetment Zone

A minor modification is needed, with willow cuttings to be planted for slope stabilization

Remediation Area

A minor modification is needed; under restoration with no visitors allowed

Islands No.4 and 6

Under restoration with no visitors allowed

Island No.5

A Country Park for Public Recreation and Nature Education
Human-wildlife separation



Approachs

Island No.1 An Ecotourism Hub



- The island is conveniently located close to nearby villages with road access and comprises former fishponds and the land filling area by the lakeside;

An Ecotourism Hub

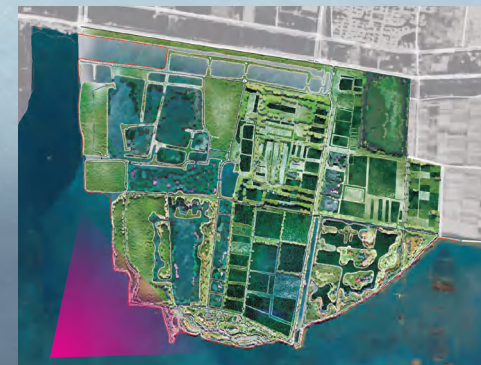
- An **"Eco + specialties industries"** model will be developed, leveraging the existing fishponds;
- The habitat for benthic fish will be restored (**fish-related cultural experiences to be explored**);
- **Plant economic crops** such as lotus roots, water chestnuts, and reeds in the wetlands, and develop the island into **a future ecotourism hub**.



1. Swimming Bird Habitat & Bird-watching Area
2. Wetland Purification Pond
3. Fish Pond (Fish Culture Experience)
4. Wetland Restoration Area
5. Ecological Tourism Area



On-Site Photography



"Preserve - Break - Integrate"

- **Preserve** existing fishpond dikes.
- **Break** dikes partially to expand water flow.
- **Integrate** and connect ponds, create an open lake, restore benthic fish habitats, and plant wetland economic crops.



Approachs

Island No.3 A Bird Island in the Middle of the Lake

- The water system will be introduced along the downstream flow paths to create the water area surrounded by woodlands, grasslands and reedbeds to form sandbanks and shoals and provide a habitat for birds and other associated species;



A Bird Island in the Middle of the Lake

- Human activities will be restricted;
 - An abandoned schoolyard will serve as a bird watching station.
 - We will provide the necessary conditions and environmental matrix for habitat restoration and we advise visitors to stay off this area until further notice.
- Habitat restoration: Pied billed grebe, black water chicken and grey goose



On-Site Photography



- 1.Human activity areas
- 2.Sandbars and shoals suitable for bird habitation
- 3.Dock
- 4.Transforming Abandoned Primary School into an Educational Research Base



**People are only allowed to conduct bird-
watching and educational activities on
designated islands.**



Approaches

Island No.5 A Country Park for Public Recreation and Nature Education



- The site is large and flat with access to embankment road for entry and exit

Nature Education Classroom

- The existing water channels will be connected into a network. Buffer zones will be provided to minimize human impact (separating bird watching areas from core bird habitats).

Future Urban Wilderness Park

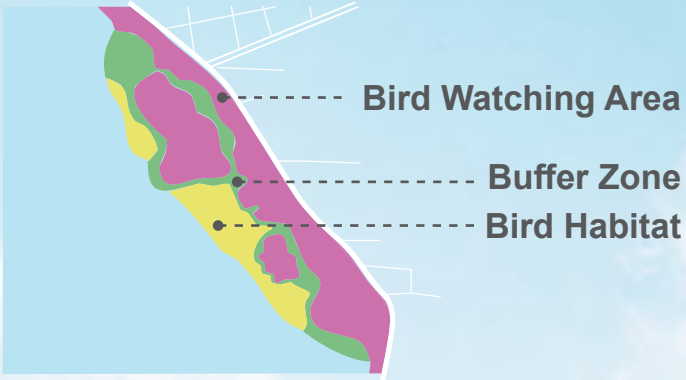
- A birding trail and bird-watching amenities are being planned.
- Habitat Restoration: Oriental Stork, Red-crowned Crane, Reed Parrotbill



1. Ecological buffer zone
2. Wetland restoration area
3. Nature Education Activity Area (Nature Education Path)



On-Site Photography



Water systems and vegetation separate human areas from bird habitats, ensuring no disturbance and creating a buffer zone.



The "island" provides a safe nesting environment for birds; the gentle slope shorelines meet the needs of waterfowl and waders.



On-Site Photography - Mud Dump

Bridges and roads meet daily patrol requirements and create a foundation for a future public park.





Approaches

Remediation area



Ecological Restoration Area

- The remediation area will undergo a minor modification, including reinforcing the upstream face and the outer revetment of the islands
- Nectar and berry shrubs and trees will be added to enrich the habitat system.

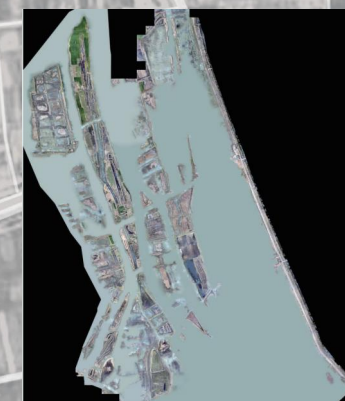
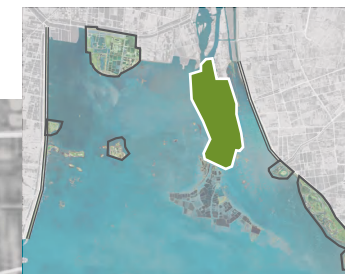
Habitat restoration: Great snipe, sandpiper, spotted duck, black water chicken, grey goose



On-Site Photography



Wanmu Lotus Pond Economic Crop Zone





Approachs

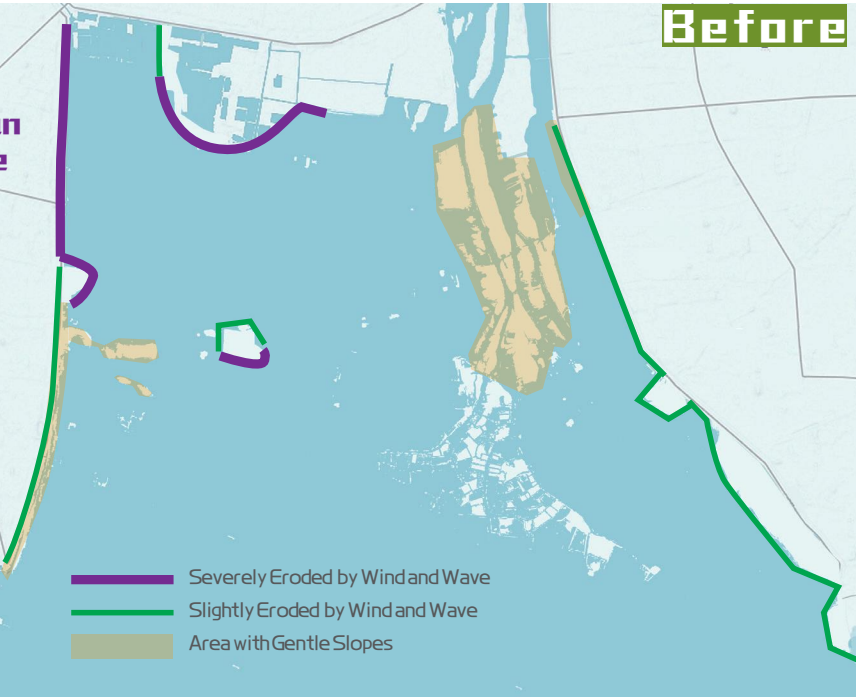
Modification of Revetment

Due to significant elevation differences, there is either insufficient space or an inability to balance the earthwork on-site.

Restoration Approach: Slope stabilization using gabions combined with emergent vegetation.



On-Site Photography



With small elevation differences, it is vulnerable to erosion by wind and waves.

Restoration Approach: Minimal earthwork, riprap, and emergent vegetation.



On-Site Photography

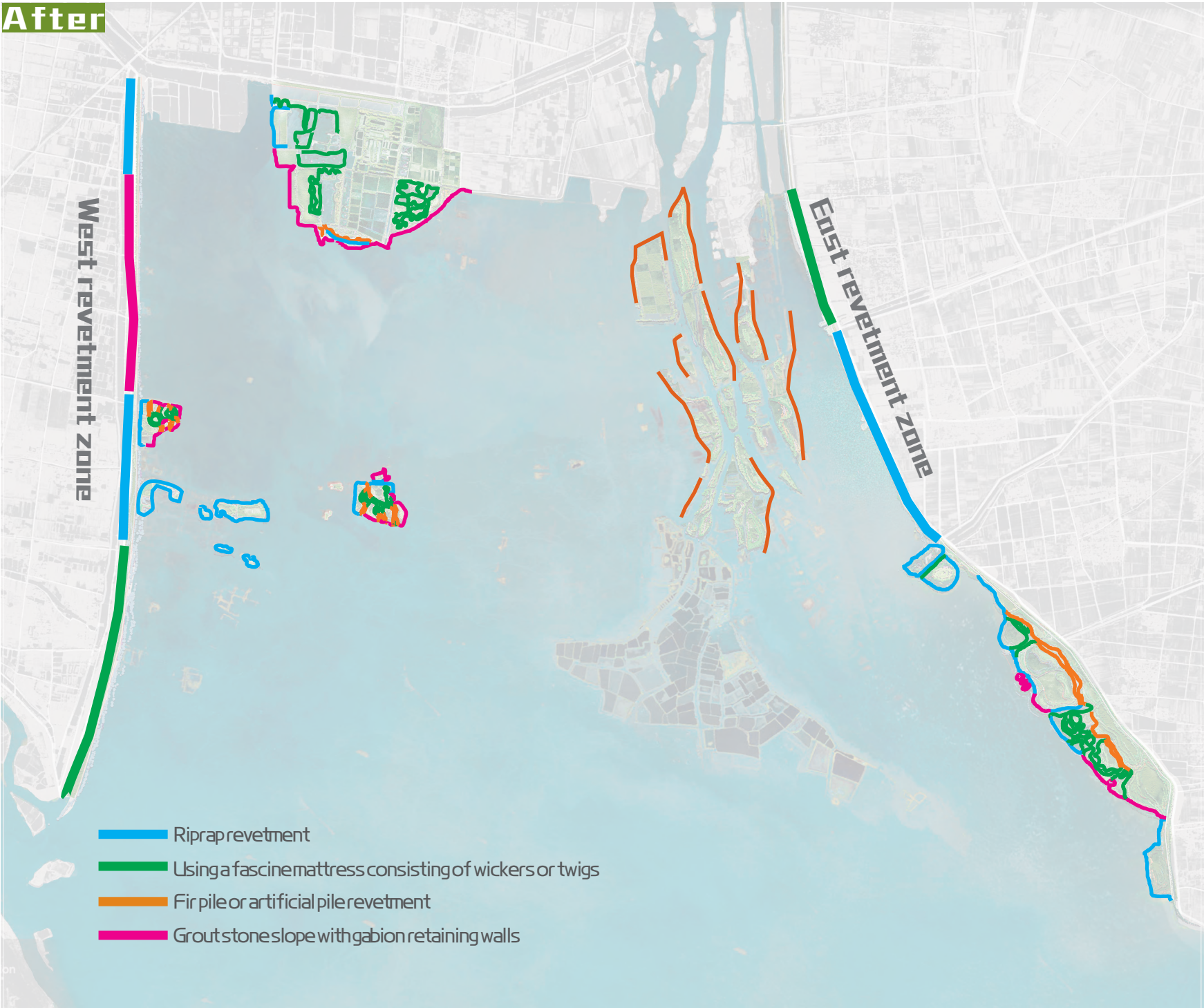
There are offshore islands, the area experiences mild wind and wave, and the current slope is gentle.

Restoration Approach: Gentle slope into the water with emergent vegetation or live willow cuttings.



On-Site Photography

After



- Riprap revetment
- Using a fascine mattress consisting of wickers or twigs
- Fir pile or artificial pile revetment
- Grout stone slope with gabion retaining walls



Approachs

Modification of Revetment

Extensive Modification

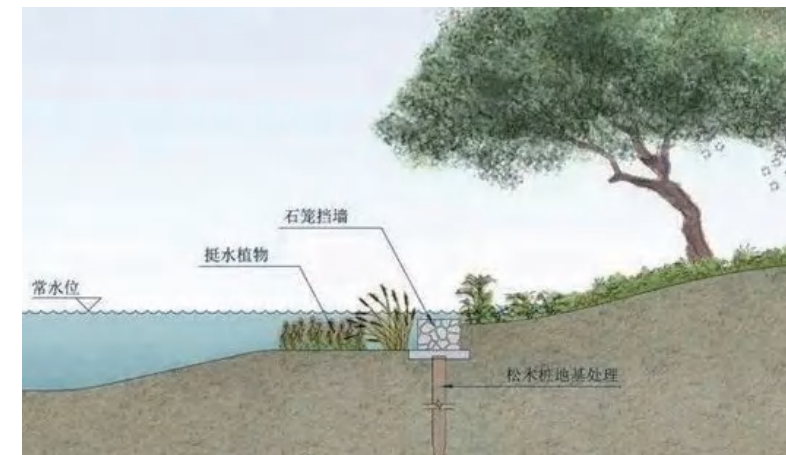
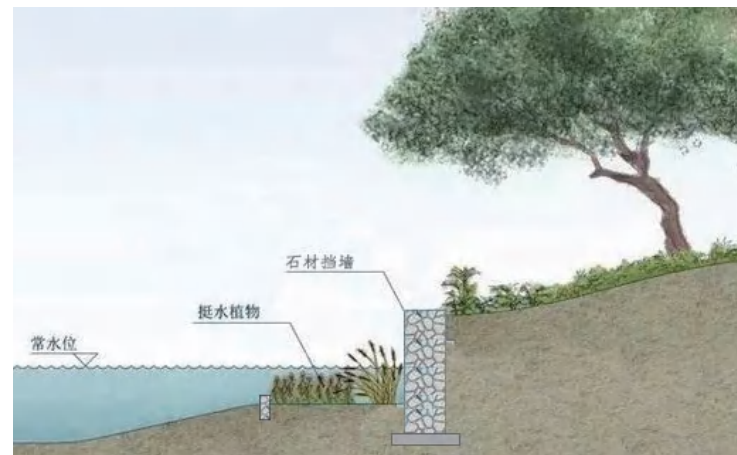
For key locations to be reinforced



Method 1:
-Gabion revetment

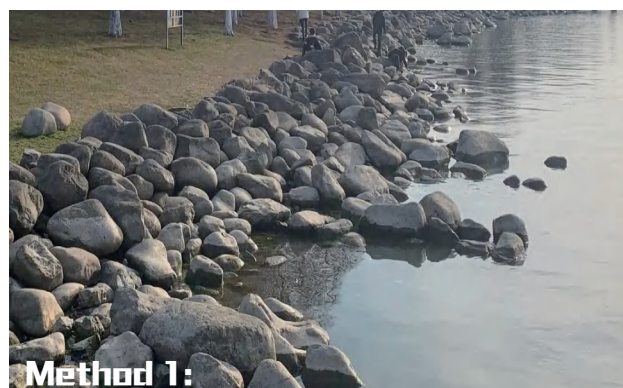
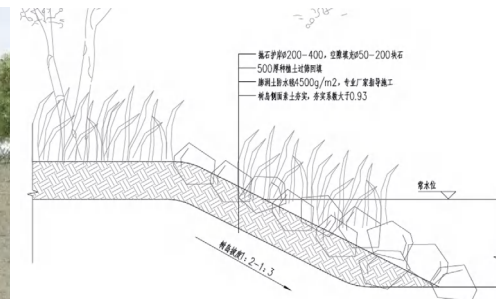
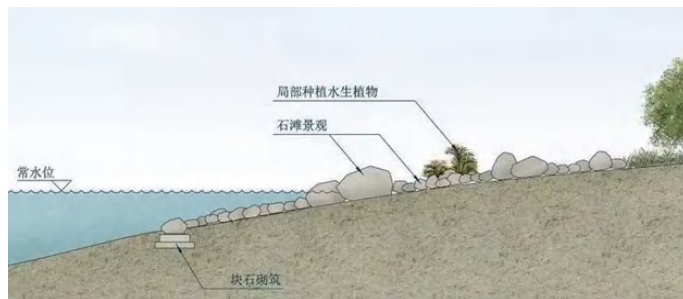


Method 2:
-Grout stone slope with gabion retaining walls



Moderate Modification

Mainly for west revetment zone



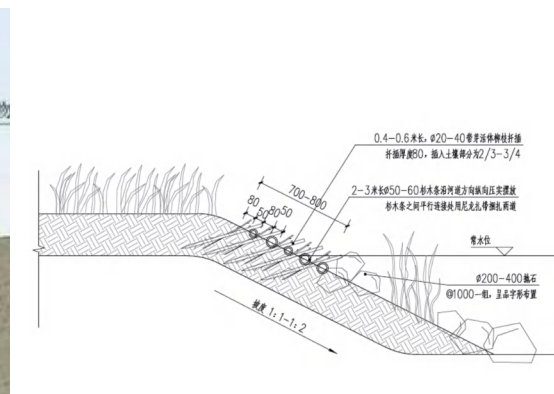
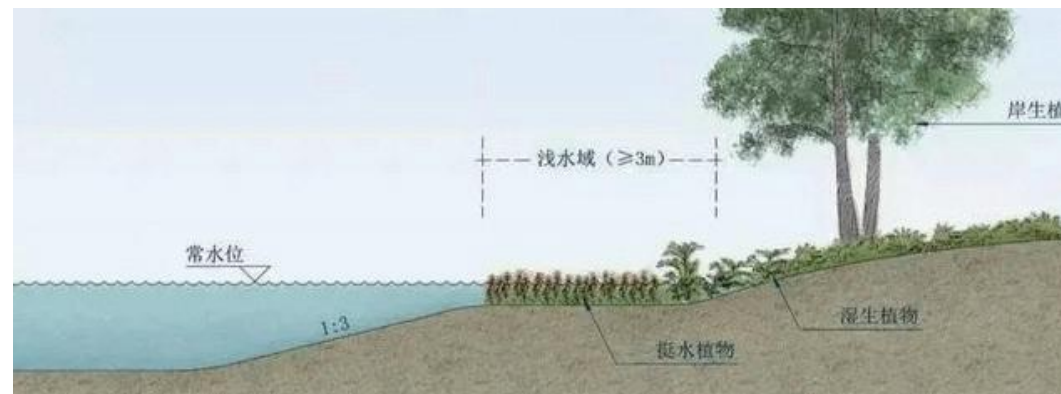
Method 1:
-Riprap revetment



Method 2:
-Fir pile or artificial pile revetment

Minor Modification

Mainly for areas around the island, remediation area and east revetment zone



Method 1:
-Gentle slope extending into the water



Method 2:
-Using a fascine mattress consisting of wickers or twigs



Method 3:
-Using a fascine mattress consisting of wickers or twigs



Approachs Planting Plan

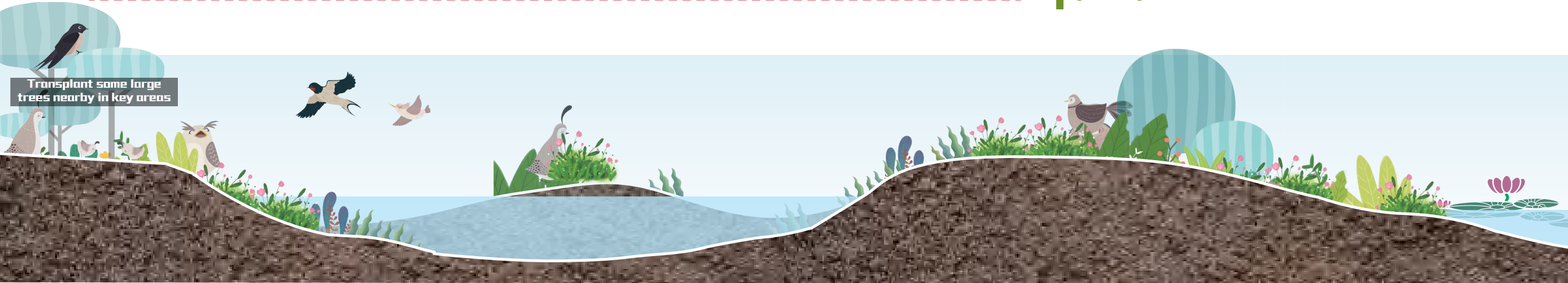
Suitable Habitat Type of Protected and Restored Objects

Bird ecological group	Habitat							
	Open water	Floating plants areaW	ater-rising plants areaW	aterside lawn areaF	armland area	Small island area in the middle of the lake	Swamp forest areaH	uman residential areas
Swimming birds	Foraging /nes ting	Foraging /res ting/nes ting	Foraging /resting/nes ting	Resting/nestingF	oraging /res ting/nes ting	Foraging /res ting/nes ting		
Waders		Foraging/nesting	Foraging/nesting	Foraging /resting/nesting	Foraging	Resting/nestingR	esting/nesting	
Scansorial birds			ForagingF	oraging /resting/nesting	Foraging		Foraging /resting/nes ting	Resting/nesting
Terrestrial birds				Foraging /resting/nesting	Foraging /res ting/nes ting		Foraging /resting/nes ting	
Fowls				ForagingF	oraging		Foraging /res ting/nes ting	Foraging /resting/nes ting
Songbirds			Foraging /resting/nes ting	Foraging /resting/nesting	Foraging /res ting/nes ting		Foraging /resting/nes ting	Foraging /resting/nes ting
Birds of prey	Foraging			ForagingF	oraging		Foraging /res ting/nes ting	Foraging

The species-site matching and localization principles

The natural and ecological principles

The sustainability and economic feasibility principles



Waterfront

Attract waders for breeding, foraging, and walking.



Shrubs:

Moso bamboo;
Goji berries;
Lonicera maackii;
etc.

Herbs:

Miscanthus sacchariflorus;
Lythrum salicaria L.;
Reeds;
etc.

Shoal Surface Flow Wetland

Attract waders for walking and foraging.



Herbs:

Cyperus involucratus Rottboll;
Iris yellow;
Canna;
etc.

Shrubs:

Symplocos tanakana Nakai;
Phoenix sylvestris.;
Chinese banana;
etc.

Open High-Alitude Grassland

Provide safe spaces and food for birds.



Herbs:

Orychopragmus violaceus;
Festuca arundinacea;
Oenothera speciosa Nutt.;
etc.

Food herbs:

Capsella bursa-pastoris (L.) Medik.;
Chamomile;
Radix ophiopogonis;
etc.

Science and Education Area

Trees, shrubs, and grasses enhance landscape quality for education.



Herbs:

Symplocos tanakana Nakai;
Euonymus japonicus Thunb.;
Goji berries;
etc.

Water-rising:

Lotus; Reed, etc.;

Floating water:

Euryale ferox, etc.;

Submerged water:

Hydrilla, etc.



Approachs

Popular Science Facility and Material



Sourced from the Internet



Sourced from the Internet



Sourced from the Internet



Sourced from the Internet



Sourced from the Internet

- A number of small birdwatching huts will be set up while making sure the floodway is not affected;
- The Interpretation system for wetland habitat will be improved along the nature education trail;

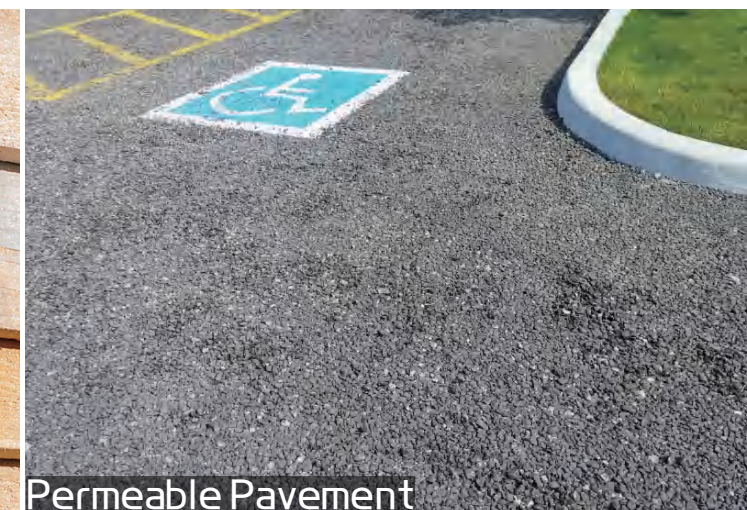
- Natural, simple, low-carbon and eco-friendly materials will be used.



Bamboo



Antiseptic Wood



Permeable Pavement

Lake Rejuvenation for Birds

From a mud dump site to a valuable habitat

