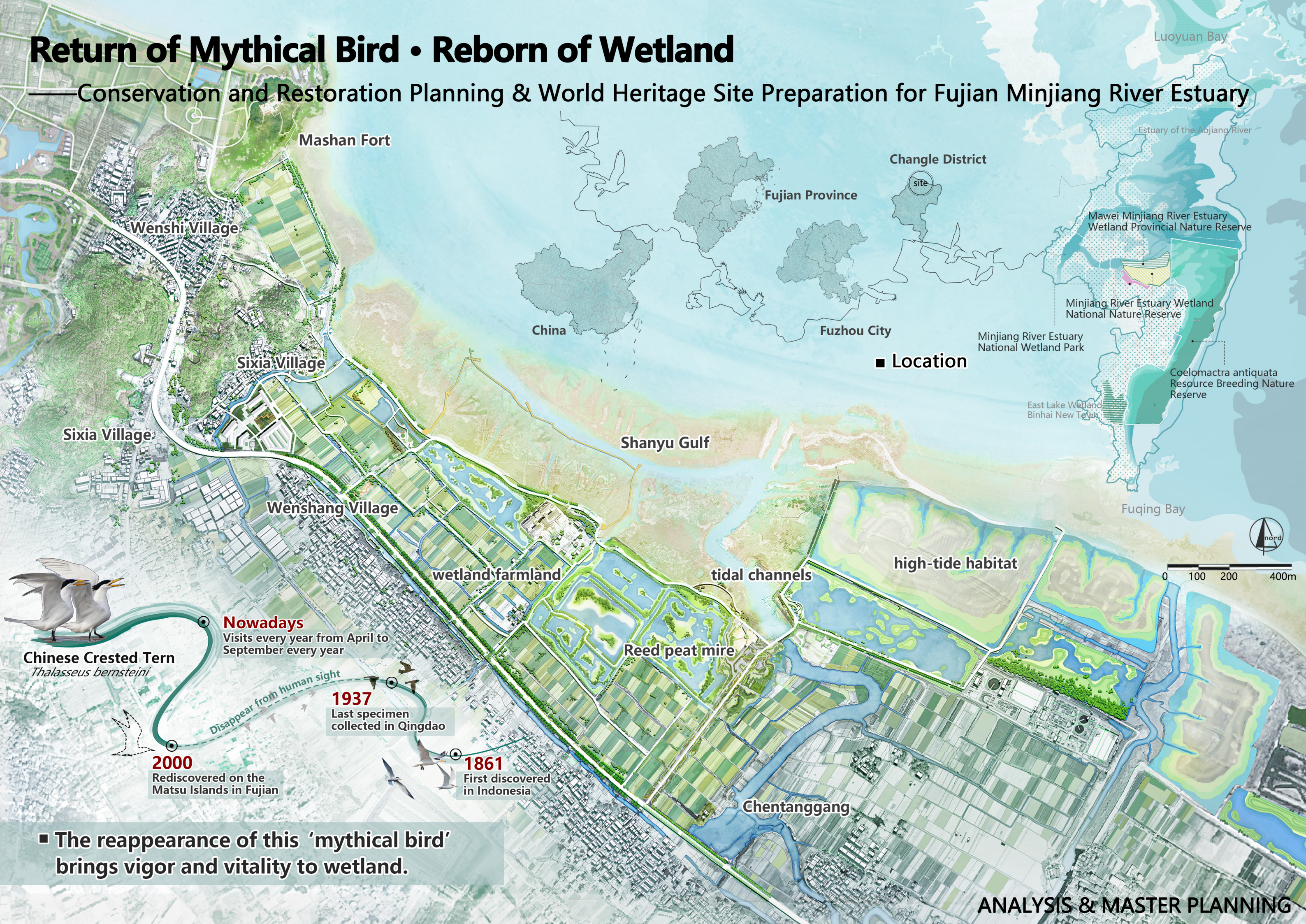


Return of Mythical Bird • Reborn of Wetland

Conservation and Restoration Planning & World Heritage Site Preparation for Fujian Minjiang River Estuary



■ The reappearance of this 'mythical bird' brings vigor and vitality to wetland.

Project Title

Return of Mythical Bird · Reborn of Wetland

-- Conservation and Restoration Planning & World Heritage Application

Preparation for Fujian Minjiang River Estuary

Project Statement

Fujian Minjiang River Estuary, located along the eastern coast of Fuzhou City, is a mudflat wetland formed by years of sedimentation from the Min River Basin. The area is a crucial node on the EAAF for migratory birds, and is a refuge for many endangered species. 24 years ago, the reappearance of a mythical species added a 'mysterious' color to this wetland. The Chinese Crested Tern (***Thalasseus Bernstein***, CR by IUCN) , was once believed to be extinct due to habitat degeneration, typhoons, human interference, and low reproduction rates until its rediscovery in this area in 2000. Nowadays, from April to September each year, the 'Mythical Bird' visits as expected, bringing vigor and vitality to wetland.

In recent years, many restoration efforts have been carried out. However, phenomena such as marine cultivation, invasions of foreign species, and human interference still exist. Therefore, it is urgent to delineate the protection scope by grade, restore the habitats of endangered waterfowls, and protect the integrity and authenticity of the ecosystem.

Led by landscape architects, a cross-disciplinary team consisting urban planners, civil engineers, municipal engineers, ornithologist, wetland scientists, botanists were formed to achieve an ambitious project. The project aims to restore and enhance the wetland area, create homeland for the returning wild birds and explore the possibility of nominating this area as a World Natural Heritage site.

The plan includes 3 aspects: First, to delineate the scope of the reservation area, and establish control rules by grade. Second, to optimize the hydrological network, eliminate the impact of invasive species, and create suitable habitats; Third, to cooperate with surrounding residents to showcase the uniqueness and glamorous of World Heritage Site.

This plan effectively protected the typical wetland ecosystem, systematically restored habitats for the safe dwelling of nearly 100,000 waterbirds, benefitted 132,000 residents of the surrounding 18 communities. At the same time, we excellently accelerated the application process for World Natural Heritage, leading to its inclusion in the "World Heritage Tentative List" in August, 2022, striving to achieve a harmonious coexistence of humans and nature.

Project Narrative

1. Project Background

Over the past century, due to global warming, accelerated urbanization and food shortages, human activities are increasingly encroaching on and damaging nature. If we look at World Heritage list, 56 of them are on the verge of extinction, of which almost half are natural heritage sites. The Fujian Minjiang River Estuary, as the most well-developed, natural and typical estuary delta in the East Asian subtropical region, had undertaken many protection efforts in recent years. However, issues such as sea marine cultivation, invasion of foreign species, and human interference still put potential risk of wetland degradation.

The plan faces three major challenges: 1), The integrity and diversity of the ecosystem within the existing reservation area is insufficient, and an effective control mechanism has not been formed. 2), The hydrological network is insufficiently connected, risks such as invasive foreign species exist. High-tide habitats are missing, waterfowl habitats lack not only scale but also variation. 3), Interaction between the wetland and surrounding communities has not been established, and there is a lack of display landmarks with heritage features. Thus, how to protect the unique ecosystem of the Fujian Minjiang River Estuary, restore the 'home of the mythical bird', and assist in the application process for World Heritage has become a great challenge for both designers and all the other stakeholders.

2. Solutions & Strategy

Landscape architects and engineers from various backgrounds gathered on this significant project. Starting from in-depth scientific ecological research, we adopt nature-based solutions (NbS) to create suitable habitats for endangered water birds such as the Chinese Crested Tern, and strive to promote the regeneration of this wetland.

The project includes three aspects:

First, Delineating Reservation Area Scope & Establishing Control Rules. (1) Research the zoning system and species survey data of terrestrial and marine biotic communities worldwide, distinguish the habitat types and summarize its uniqueness based on its location and species. By comparing Min River Estuary with other World Natural Heritage sites in the Yellow Sea and Bohai Sea region, we identified its OUV as "one of the most important natural habitats for in-situ conservation of biological diversity," meeting criteria X of World Heritage application. (2) Conduct adaptability analysis for habitats of Chinese Crested Tern and other five most representative critically endangered species, combine it with the existing reservation area division, and delineate a 417.9 km² heritage reservation area to ensure the integrity and diversity of the estuary wetland ecosystem. (3) Establish graded zoning control rules for the heritage site, clarify the prohibition and admission list, designate a 14.6 km² coordinated development zone outside of the buffer zone to promote the sustainable development of the surrounding communities.

Second, Systematically Restoring Ecosystem and Creating Bird Habitats. (1) Optimize the surface water system. Redefine hydrological units, manage the inlet and outlet water channels, add two smart water gate so natural exchange of water body can be realized with tides. Develop water level regulation mechanism that meets the need of waterfowl habitats by using monitoring data collected from 3 tide gauge stations nearby. (2) Replace the occupied ecological niches. By employing physical methods such as 'mowing, tilling, site preparation and plantation restoration', we strive to manage invasive species, such as *Spartina alterniflora* (*Spartina alterniflora* Loisel) in this area. Local salt marsh plants such as mangroves, reeds (*Phragmites australis*), *Cyperus malaccensis* (*Cyperus malaccensis subsp. monophyllus*), and *Scirpus mariqueter* (*Bolboschoenoplectus mariqueter*) are planted in suitable areas. (3) Create diverse bird habitats. Protect and restore intertidal beaches to provide 100 hectares of core habitat and foraging grounds for migratory birds such as the Chinese Crested Tern. Within the sea dyke, create 118 hectares of bare beaches as supplementary high-tide habitats. Re-shape fish ponds, control the water depth fluctuating from 0.1-0.3m with a gentle slope of $\leq 3\%$ to provide suitable habitats for waterfowls such as Black-winged Stilt (*Himantopus himantopus*) and Pied Avocet (*Recurvirostra avosetta*).

Third, Collaborating with Surrounding Residents and Demonstrating a World Heritage Showcase. (1) Based on the population distribution and location characteristics of surrounding villages, coordinate the general layout of wetland research, natural and cultural tourism to create a World Heritage community with wetland characteristics. (2) Promote community participation, strengthen science popularization, activate heritage values, provide employment opportunities, and train a new generation of heritage site guardians. (3) Establish the Chinese Crested Tern as the iconic species of the Fujian Minjiang River Estuary, extract its playful postures of courtship, breeding, and nesting, and incorporate them into the design of the wetland museum, entrance gate, and other nodes to form a distinctive World Heritage showcase.

3. Practical & Scientific Implementation Plan

(1) Reliable: Analysis tools and site investigation to ensure reliability

Using technical methods such as 3S and Analytic Hierarchy Process (AHP), we construct a habitat suitability evaluation model to predict the potential habitat distribution pattern of the five most representative critically endangered bird species. Meanwhile, we conducted site investigation with wetland ornithologists to ensure reliability of our program.

(2) Feasible: Cooperating with the stakeholders to ensure the feasibility

We worked closely with stakeholders in Fuzhou to collect relevant information as comprehensive as possible, analyzed possible problems and constraints of wetland conservation the development of surrounding areas. Through close communication with experts and local residents, common acknowledgement was reached, specific ecological restoration plans were formulated based on current conditions.

(3) Rational: Cross-disciplinary team to ensure quality

Led by landscape architects, a cross-disciplinary team including urban planners, municipal engineers, environmental engineers, civil engineers, wetland ecologist, restoration experts and ornithologists worked together to solve these complex problems. Challenges such as ecological restoration, invasive species management, bird protection, visitor regulation and interference reduction were solved through this collaboration from the beginning.

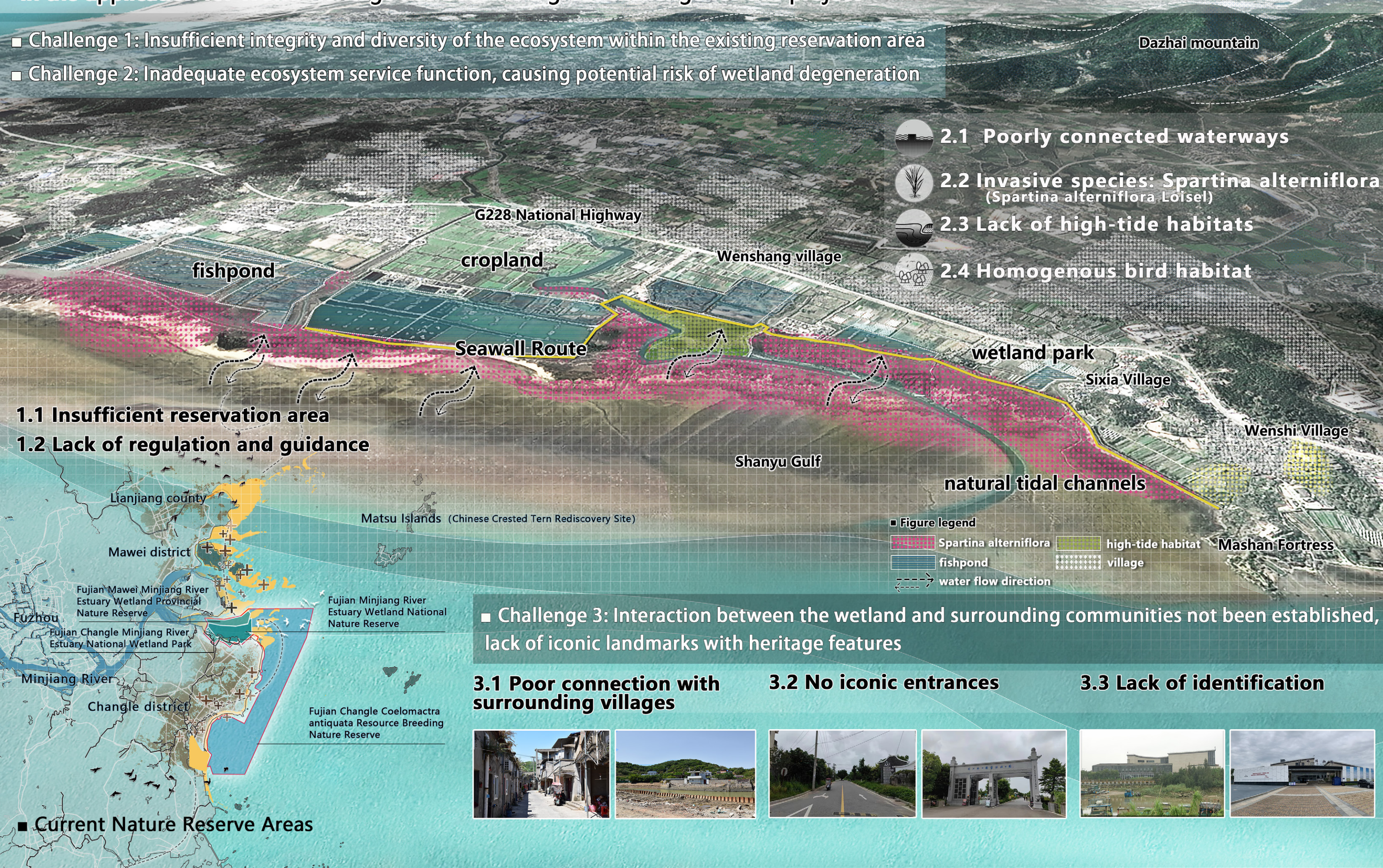
4. Expected Benefits

The plan, if implemented successfully, shall systematically restore 315ha waterfowl habitat, control 182ha of invasive species, supplement 118ha high-tide habitats, and lay out a 14.6km² heritage co-development zone, benefitting 20 surrounding communities and a total of 132000 residents. At the same time, the plan has greatly accelerated the process of the Fujian Minjiang River Estuary's application for Wetland of International Importance and World Natural Heritage sites. In August 2022, the 'Fujian Minjiang River Estuary: The ecotone between marine and terrestrial biogeographical regions' was successfully listed in the World Heritage Tentative List by UNESCO. In February 2023, it was included in the Ramsar Convention List of Wetland of International Importance, providing an important demonstration for the protection and restoration of natural heritage sites from a global perspective.

Challenge Factors

— How to protect the unique ecosystem of the Fujian Minjiang River Estuary, restore the "home of the mythical bird", and assist in the application for World Heritage has become a great challenge for this project

- Challenge 1: Insufficient integrity and diversity of the ecosystem within the existing reservation area
- Challenge 2: Inadequate ecosystem service function, causing potential risk of wetland degeneration

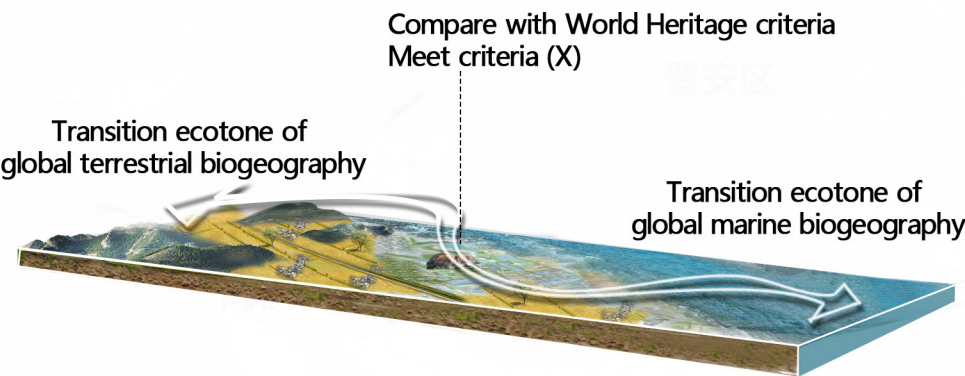


Solution & Vision

SOLUTION 1

Delineate Protection Area Scope
Establish Control Rules

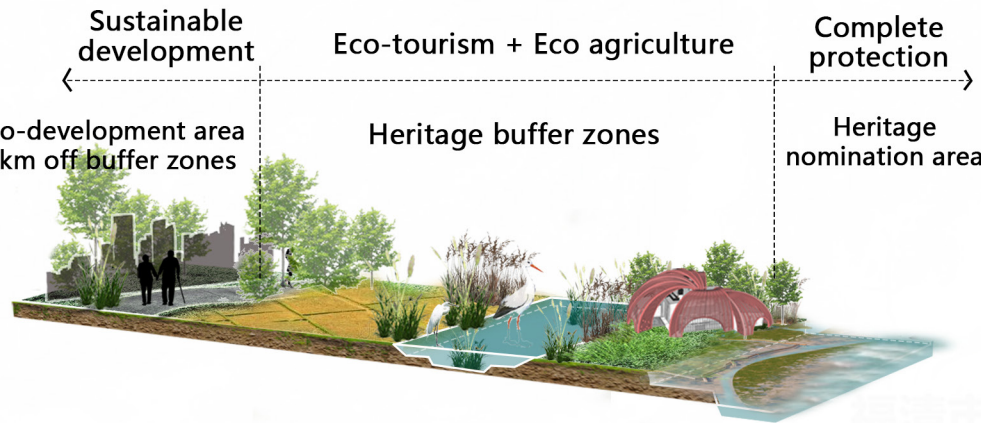
1. Define Outstanding Universal Value(OUV)



2. Optimize reservation zoning system



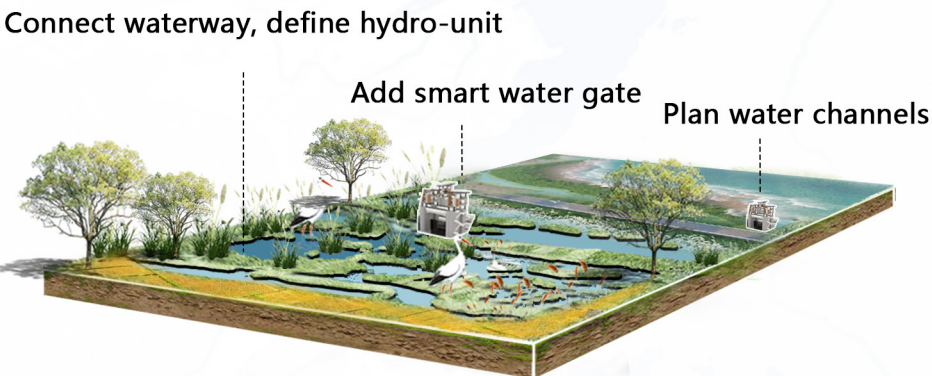
3. Regulation rules by grade and by scope



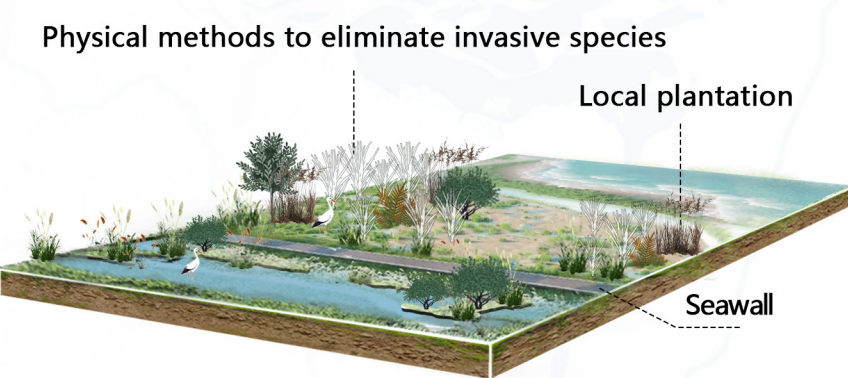
SOLUTION 2

Systematically Restore Ecosystem
Create Bird Habitats

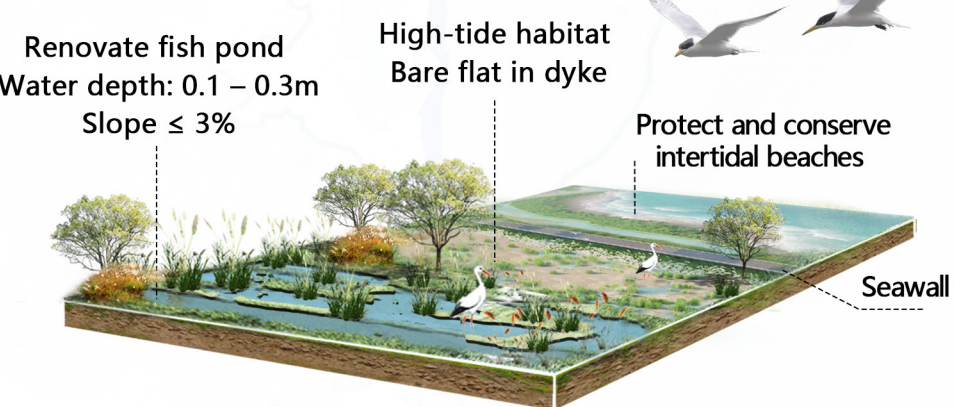
1. Optimize surface water system



2. Replace the occupied ecological niches



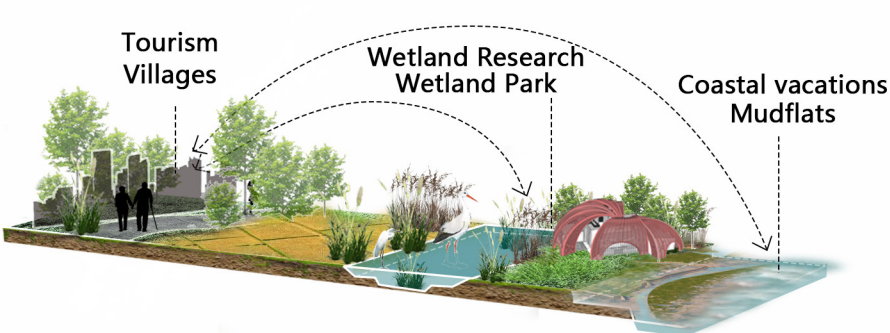
3. Create diverse bird habitat



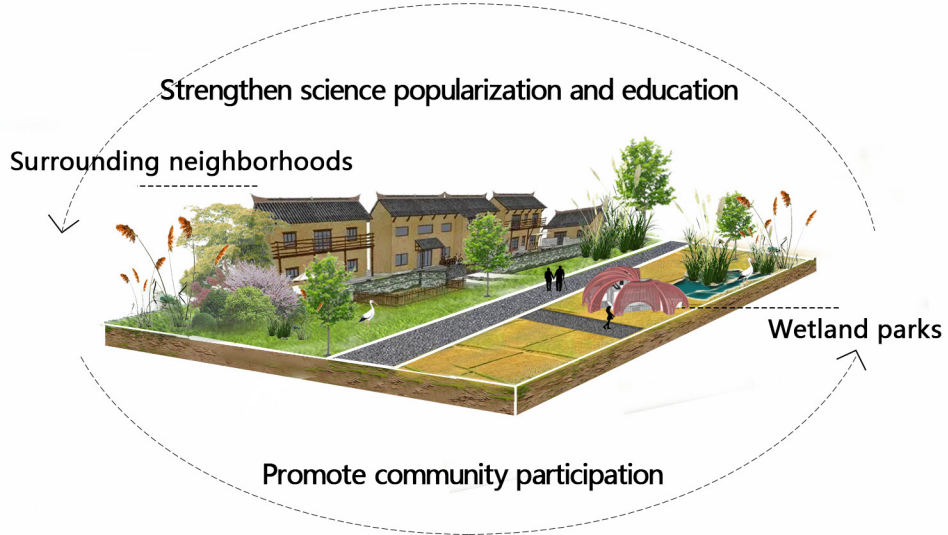
SOLUTION 3

Collaborate with Surrounding Residents
Demonstrate a World Heritage Showcase

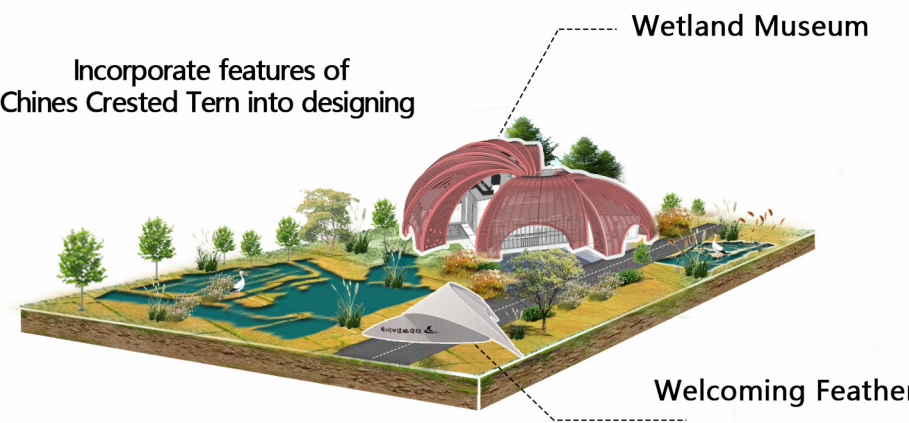
1. Co-development between wetland & communities



Coordinate wetland research, sea-viewing vacations and cultural and leisure functions around the wetland area



2. Build World Heritage Landmarks

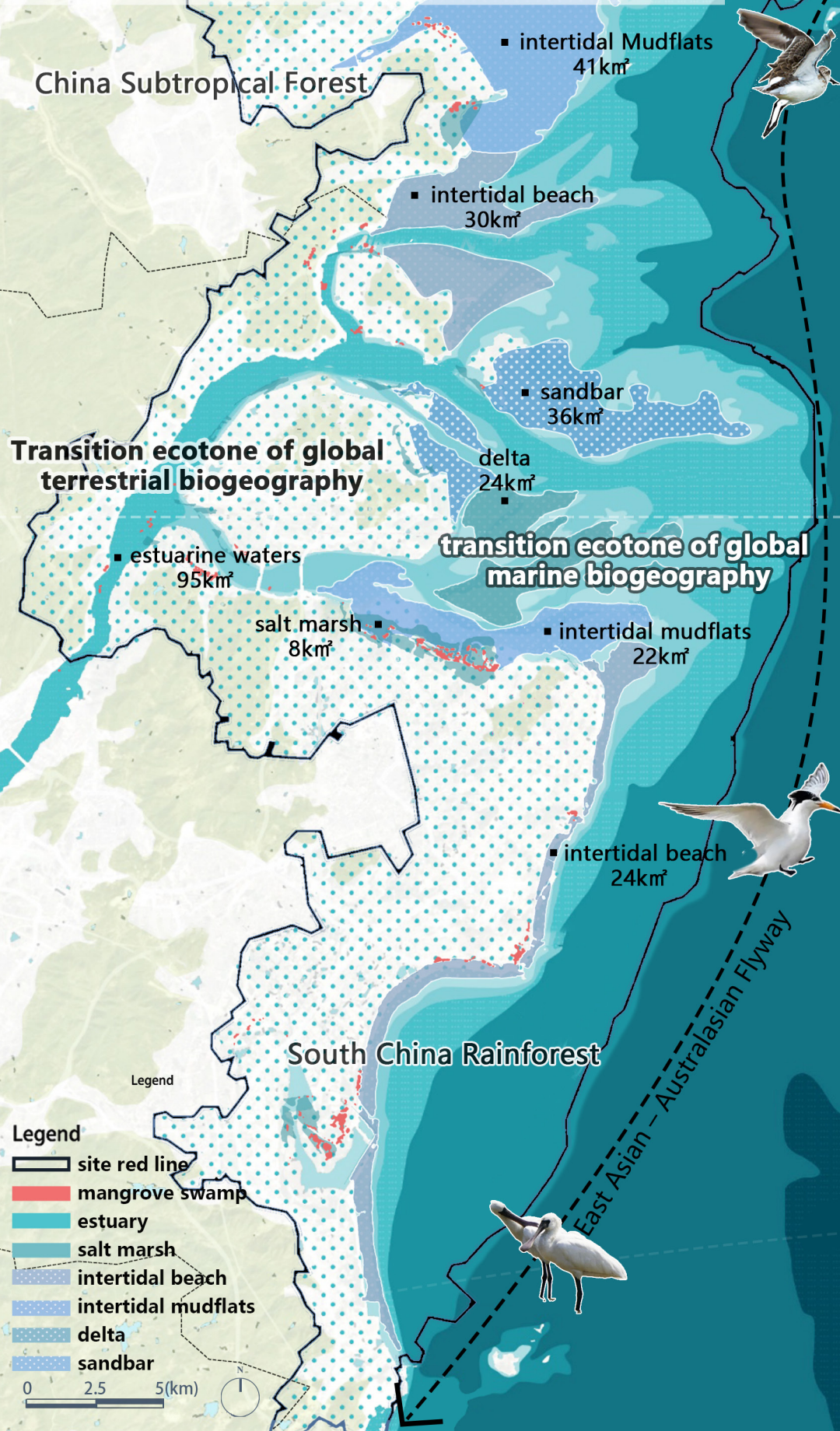


Guarding A Healthy Ecosystem, Promoting the Reborn of the Wetland

Solution 1: Indentify OUV & Delineate the Scope of the Reservation Area

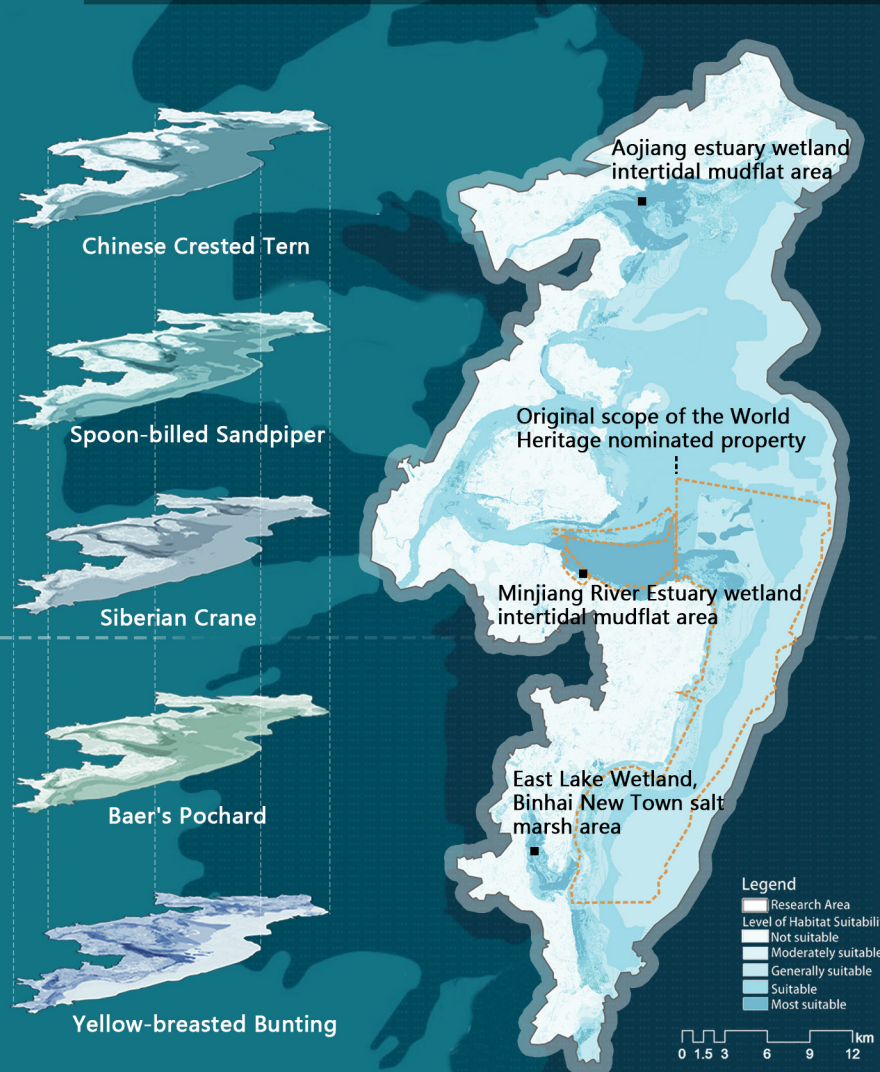
1. Analysis of regional uniqueness

Located in the transition ecotone between two global terrestrial biogeographic and marine ecoregions, as well as one national zoogeography transition zone



2. Habitat suitability analysis of representative species and optimization of protected areas

Habitat adaptation analysis of the five most representative endangered species



Habitat Analysis

Habitat Adaptation Analysis

Reservation area optimization Plan & Control rules by region

Area of Nominated Property -- Key Preservation Areas

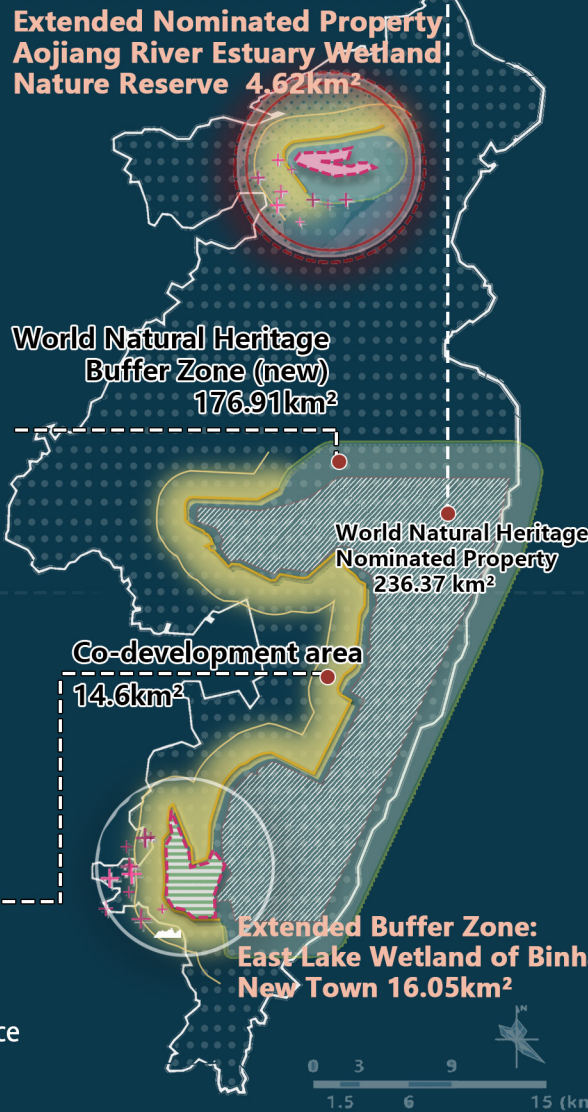
- Strictly Prohibited :** Full protection of wetland ecology and migratory bird habitat; No introduction of invasive species;
- With Monitor :** Human activities and construction; Ecological monitoring; Heritage restoration...

Area of Buffer Zones -- Env. Harmonization Areas

- Strictly Prohibited :** Reclamation; Destruction of wildlife habitats; Aagricultural production; Urban and rural construction...
- Allowed :** Sustainable ecological agriculture; Scientific research; Science education..

Area of Co-dev. Zones -- Coordinated Dev. Areas

- Pomote integration and development** of the 'production-living-ecology' space



OUV Identification

Comparative Analysis of Yellow Sea and Bohai Sea Heritage Sites

	Name	Criterion	Number of bird species	IUCN threatened species (birds)	Number of critically endangered species (birds)
Migratory Bird Sanctuaries along the Coast of Yellow Sea-Bohai Gulf of China (Phase I)	Yancheng Wetland Rare Birds National Nature Reserve, Jiangsu (YS-1)	x	415	17	1
	Yancheng Wetland Rare Birds National Nature Reserve, Jiangsu (YS-2)	x			
Migratory Bird Sanctuaries along the Coast of Yellow Sea-Bohai Gulf of China (Phase II)	Yellow River Delta National Nature Reserve, Shandong	x	381	30	3
	Liaohokou National Nature Reserve, Liaoning	x	292	22	3
	Dandong Yalu River Estuary National Nature Reserve, Liaoning	x	254	23	4
	Getbol, Korea Tidal Flats	x	118	22	1
	Fujian Minjiang River Estuary	x	312	25	5

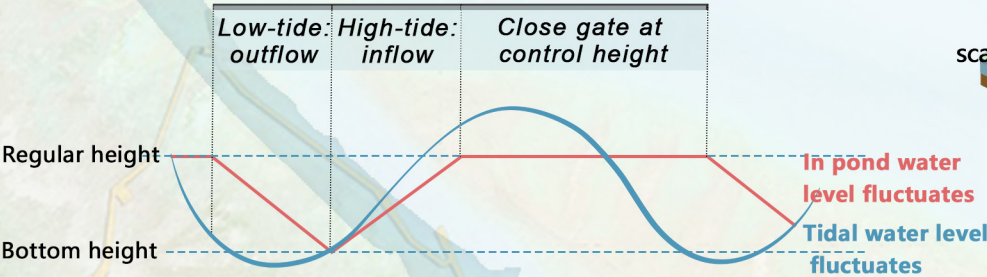
OUV is 'one of the most important natural habitats for in-situ conservation of biodiversity', with the potential to be nominated for World Natural Heritage 'Criterion (x)'

Solution 2: Optimize Surface Water System

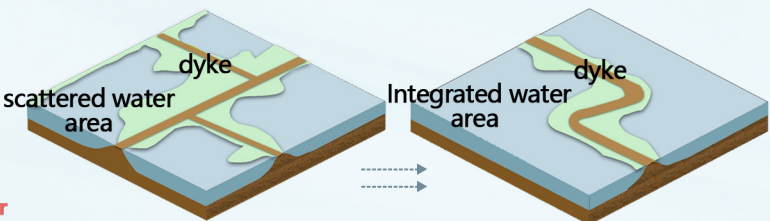
1. Redefine hydrological units, manage the inlet and outlet water channels, add two smart water pump so natural exchange of water body can be realized with tides.
2. Develop water level regulation mechanism that meets the need of waterfowl habitats, using monitoring data collected from 3 tide gauge stations nearby.

Regulation water level mechanism

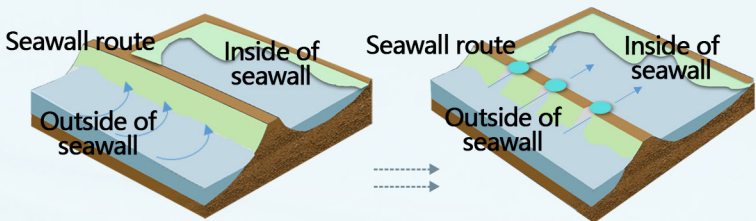
Using smart water pump to regulate water level of each units, meeting the needs of bird habitats



Strengthen internal and external connectivity

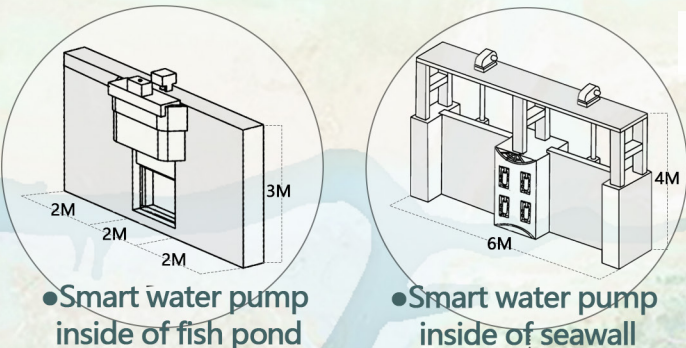


• Fish pond(in-dyke): gathering & assembling



• Fish pond(out-dyke): elimination & introducing

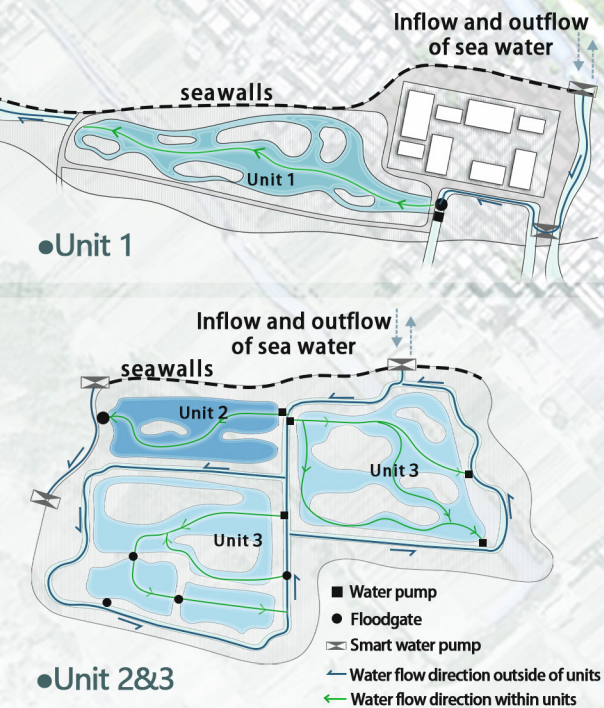
Example of water pump



• Smart water pump inside of fish pond

• Smart water pump inside of seawall

Divide water units



• Unit 1

• Unit 2&3

seawall

UNIT I
(water depth 0.1-0.3M)

Low-tide: outflow

High-tide: inflow

UNIT II
(water depth <0.1M)

(water depth 0.3-0.8M)

UNIT III
(water depth 1-1.5M)

UNIT III
(water depth 0.3M-0.8M)

Inside of seawall

Low-tide: outflow

High-tide: inflow

0.78

UNIT IV
(water depth <0.1M)

outside of seawall

UNIT IV
(water depth 0.3-0.8M)

Figure legend

Planned Hydraulic Structures

- New smart water gate
- New internal water gate
- Unblocking culvert

- One-way culvert
- Mobile water gate

Current Hydraulic Structures

- Water gate on seawall route
- Internal water gate
- Culvert

- Water flow direction outside of fish pond
- Water flow direction outside of fish pond

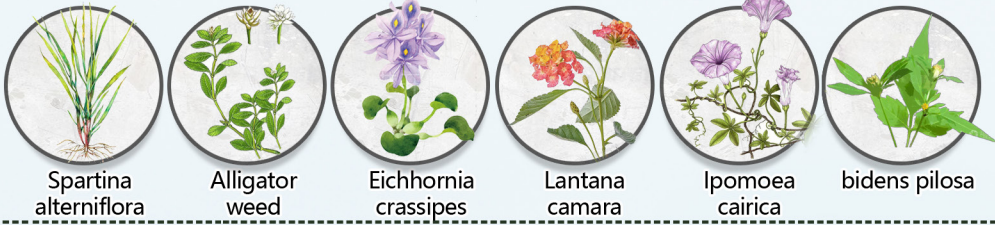
Solution 2: Replace the Occupied Ecological Niches

■ Employ physical methods to manage 6 kinds、 182ha of invasive species. Gradually replace local plantation at suitable areas

Remove Major Invasive Species

6 SPECIES

Invasive species, such like lantana and bidens pilosa

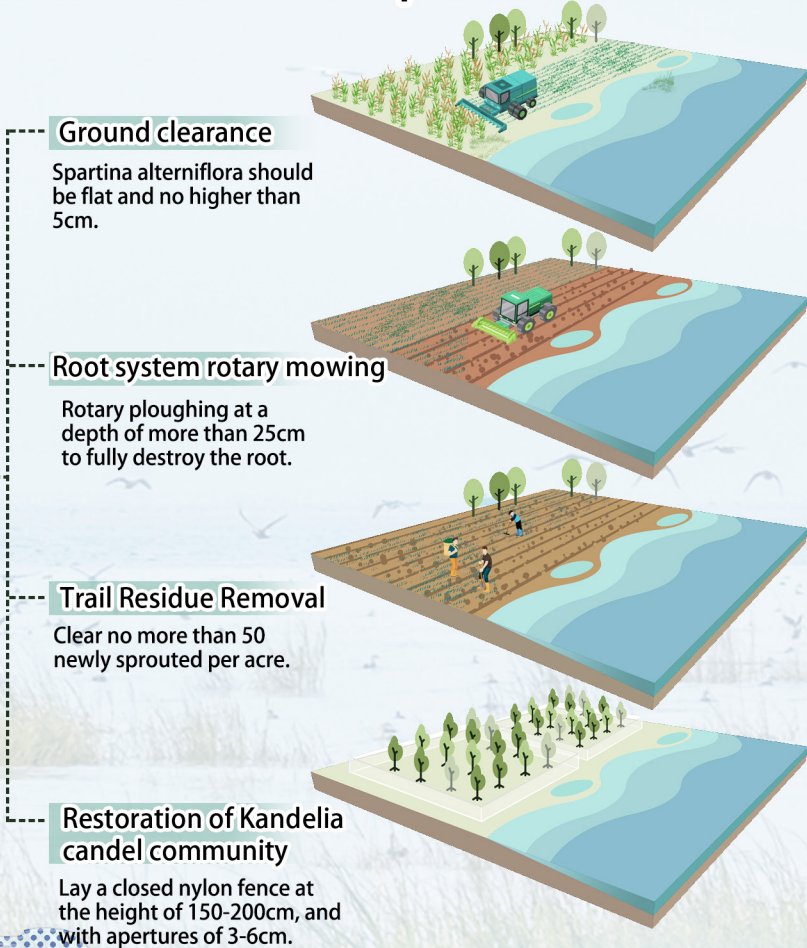


Rehabilitate with Local Plantation

182ha

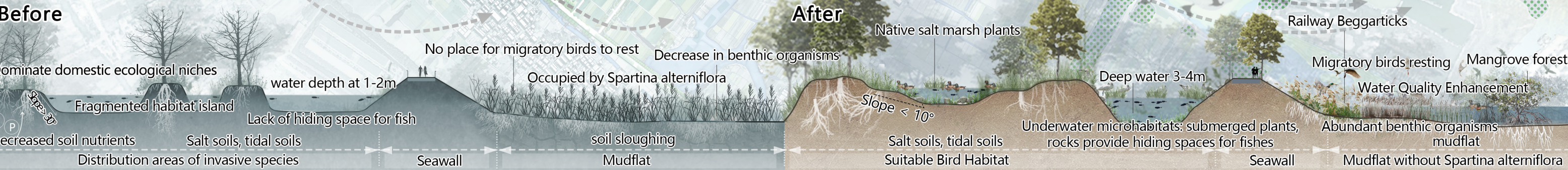
Restoration of salt marsh plants

■ Management mechanism of Spartina alterniflora



■ Distribution area of Spartina alterniflora
■ Distribution area of other invasive species

Replace the occupied ecological niches: manage invasive species and plant local salt marsh plants such as mangroves, reeds, Cyperus malaccensis, and scirpus mariqueter in suitable areas.



Solution 2: Creating Diverse Bird Habitats

BEFORE

Homogenous habitat type with poor quality

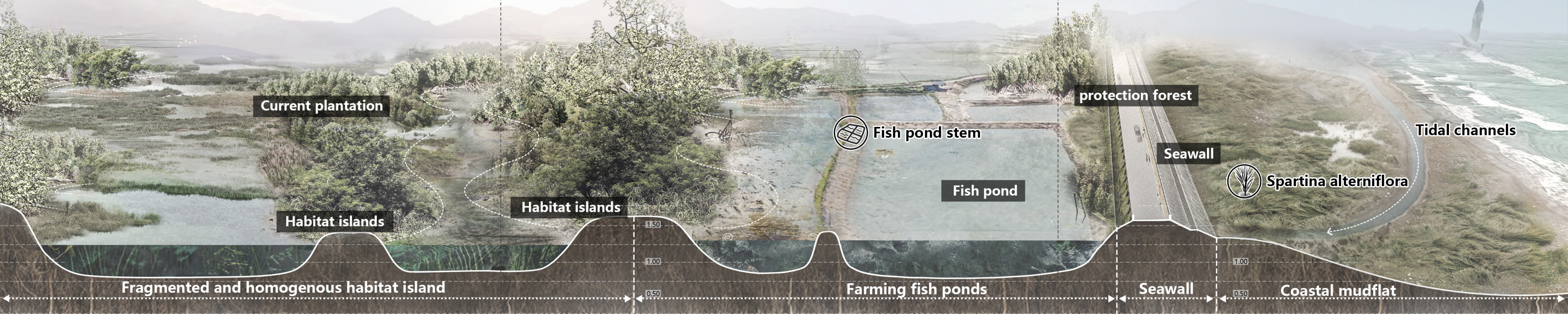
- Excessive slope of habitat islands
- Scattered habitat island, lack of water level regulation
- Disorder plantation with single type

Fishpond causing negative impact on bird habitats

- Lack of habitat and breeding space
- Current fishpond not conducive to waterfowl foraging
- Severe human interference

Spartina alterniflora invading the intertidal zone

- More than 90% occupied
- Lack of local salt marsh plantation
- Poor connectivity of water systems inside and outside of the seawall



AFTER

Enriching habitat types and improving quality

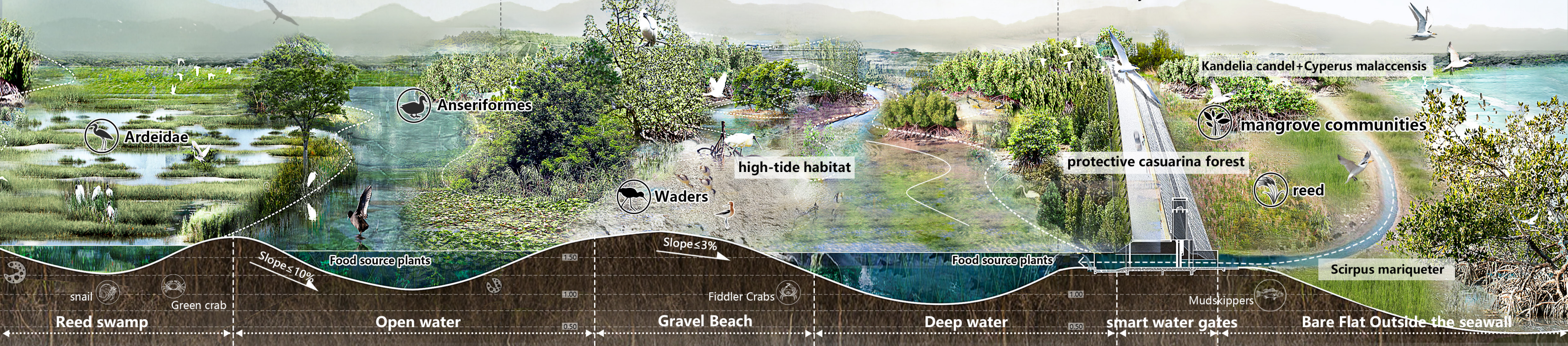
- Flat slope to $\leq 10\%$
- Merge fragmented islands and water surface, control water depth with 0.1-0.3m
- Enrich wetland plantation types

Supplementing high-tide habitats

- Build 118ha of gravel beach from local area, particle size to be 2-5cm
- Remove the pond stem and release benthic organisms
- Add casuarina protective forest belts to reduce interference

Protecting and restoring intertidal beaches

- Provide a core habitat and forage area of 100ha for migratory birds such as the Chinese Crested Tern
- Manage invasive species and rebuild wetland plantation
- Add smart water gates to connect the internal and external water systems



Solution 3: Promoting Synergistic Development with Surrounding Villages



1 Based on the population distribution and location characteristics of surrounding villages, coordinate the general layout to create a World Heritage community with wetland characteristics.



2 Promote community participation, strengthen science popularization and provide employment opportunities.



3 Desire for a closer connection with nature of 132000 residents from 18 communities realized

Meihua Historic Town

Famous Coastal Defense Town,
Mountain and Sea Settlement

Yuandang Alley

Master Gathering,
Heart of Min River

Kefeng Village

Loyalty and Valor
Countryside Leisure

Jiang Qiantou

Amazing Stones, Farmland Scenery

Wenshang Village

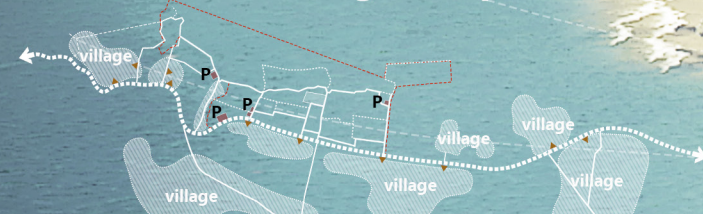
Historical Bayan Path Shimmering



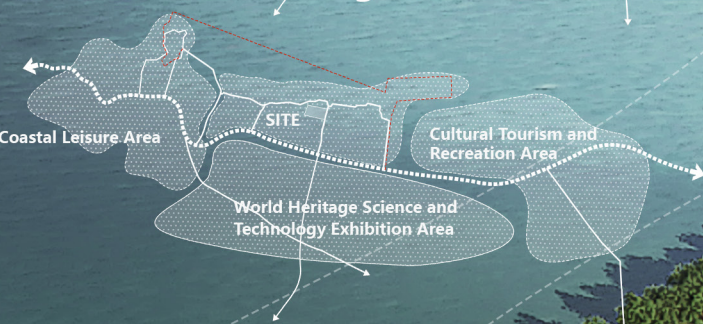
Cultural Tourism and Recreation Area

Utilization of Historical and Cultural Resources

Site & Surrounding Transportation



Site & Surrounding Communities



Tidal channels

World Heritage Science and Technology Exhibition Area

Promoting Coexistence between heritage and communities



Coastal Leisure Area

Implantation of Tourism Industries

Sixia Village

Waterside Towns
Fisherman's Home

Wenshi Village

Remembrance of the Past
Return to Homeland

Mazu Square

Mashan Fort

Solution 3: Demonstrate a Unique World Heritage Showcase

Renovation of Wetland Museum

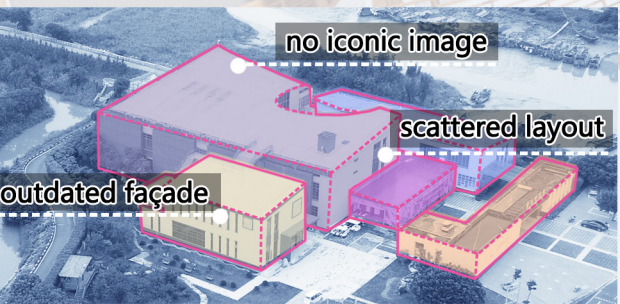


Current issues

- 1.Scattered layout
- 2.Outdated façade
- 3.No iconic image

Designing inspirations

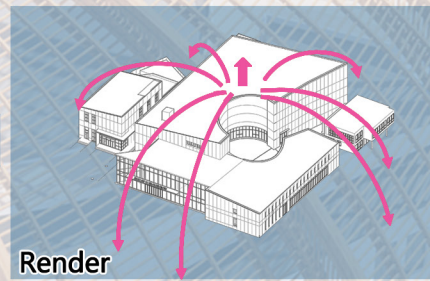
Extract the wing shape of the Chinese Crested Tern when it returns to its nest, and gently gather the scattered buildings into the embrace of the mythical bird.



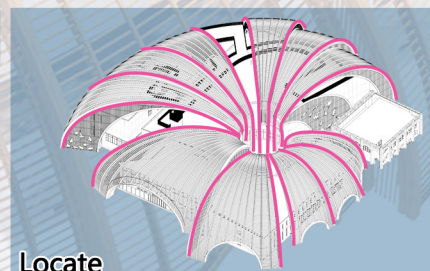
no iconic image
scattered layout
outdated façade



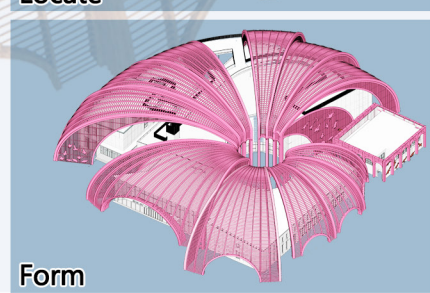
Abstract



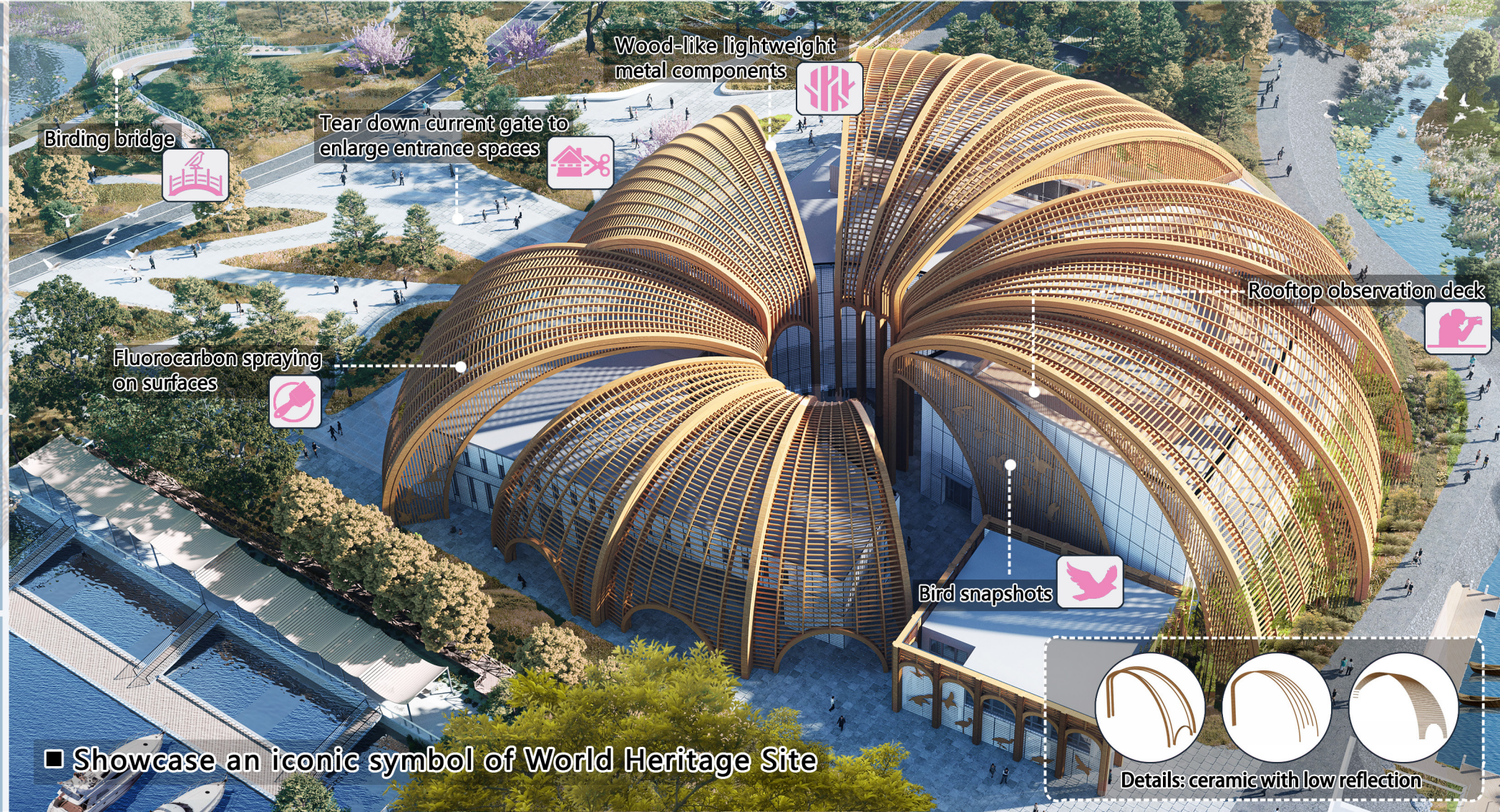
Render



Locate



Form



Birding bridge

Tear down current gate to enlarge entrance spaces

Wood-like lightweight metal components

Fluorocarbon spraying on surfaces

Rooftop observation deck

Bird snapshots

■ Showcase an iconic symbol of World Heritage Site

Details: ceramic with low reflection

Entrance Gate: Welcoming Feather



PTFE coating

Leisure square

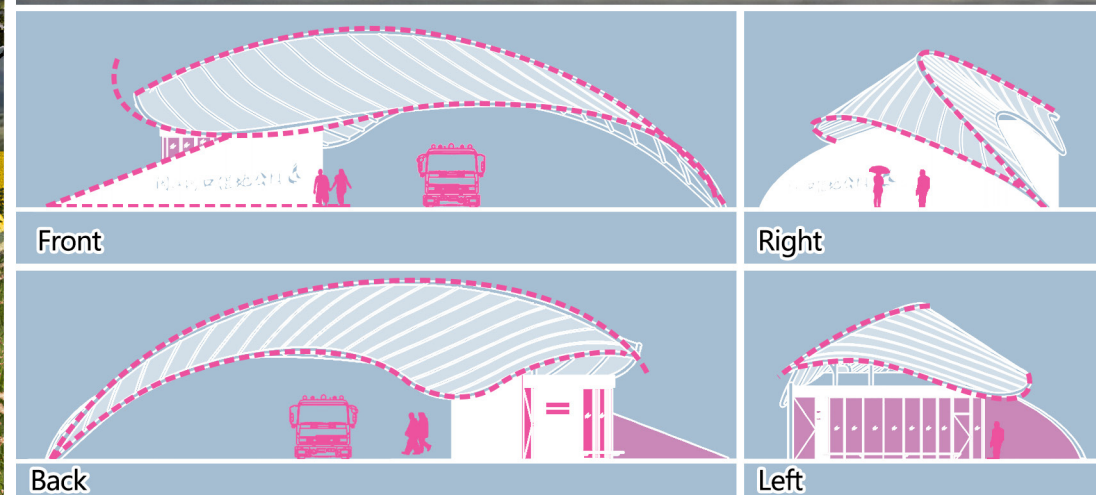
Purple loosestrife

Metal grille

Extract the features of Chinese Crested Tern wings, outline with smooth lines and agile postures, so guests from all directions are warmly welcomed.



■ Features of the wings of the Chinese Crested Tern



Front

Right

Back

Left

■ Entrance façade from different perspectives

Comprehensive Benefits

Providing an important demonstration for the protection and restoration of natural heritage sites from global perspective, making humans and living creatures reside, coexist and prosper together



ACCELERATE WORLD HERITAGE APPLICATION PROCESS

- 1 In August 2022, it was successfully listed in the World Heritage Tentative List
- 2 In February 2023, it was included in the Ramsar Convention List of Wetland of International Importance



COMPREHENSIVE ECOSYSTEM RESTORATION

- 1 Restore waterfowl habitat: 315ha
- 2 Manages invasive species: 182ha
- 3 Create high-tide habitats: 118ha



DEMONSTRATE WORLD HERITAGE SHOWCASE

- 1 Desire for a closer connection with nature of 132000 residents from 18 communities realized
- 2 Renovate wetland museum into an iconic architecture
- 3 Incorporating features of Chinese Crested Tern into design

