# IFLA ASIA-PACIFIC LA AWARDS 2023

## Awards Categories:
## Parks and Open space

The Three Lakes In Guangzhou Zoo:

Landscape renovation and renovation of waterfowl exhibition area in urban zoo

## PROJECT TITLE

The Three Lakes In Guangzhou Zoo: Landscape renovation and renovation of waterfowl exhibition area in urban zoo

## PROJECT STATEMENT

The Three Lakes Exhibit in Guangzhou Zoo is a waterfowl exhibition area that provides an integration of animal exhibition, protection education, ecological purification and leisure. Its renovation has achieved significant ecological and social benefits.

As the largest waterfowl exhibition area and the most concentrated outdoor leisure lake area in Guangzhou Zoo, the project takes lots of work in the improvement of water environment, animal welfare and management efficiency, quality and safety of exhibition facilities, also enriched regional plant diversity.

We gave full consideration to the needs of animals, tourists and breeders, greatly improved the exhibition environment and animal welfare of the Three Lakes. In addition, the design provides a continuous safe habitat for wild birds to stay, breed and roost.

# PROJECT NARRATIVE AND CONTENTS

## 1.OVERVIEW

Founded in 1958, Guangzhou Zoo is the urban zoo with the largest number of animals and numbers in China, with a total area of 42 hectares, including 36 hectares of external exhibition area and 6 hectares of logistics & conservation area.

## 2.SIGNIFICANCE

### 2.1 National zoo that representsfor the Lingnan region

Bringing into play the characteristics of Lingnan area, with modern Lingnan style as the keynote, the project features in ecology, fashion, simplicity and grandeur. The establishment of national zoo standard in South China not only creates a characterized zoo, but also provides a design guideline, combining urban animals and the community of human destiny.

### 2.2 Biodiversity impacts

After the renovation, reared waterfowl are healthier and easier to breed. In addition, more urban wild waterbirds have chosen this site as a continuous safe habitat for wild birds to stay, breed and roost, protecting biodiversity in the city.

### 2.3 Educational impact on conservation

The enhancement of the environment and sense of security has resulted in a significant surge in tourist visits. The newly added interactive educational facilities allow visitors to gain insight into the physical characteristics, behavior, and habitats of animals, thereby strengthening their awareness of coexisting with wildlife.

## 3.UNIQUE AND INNOVATIVE DESIGN

Balancing the needs of animals, visitors, and administrators is the key to designing a successful zoo. The animal's needs include mating, rearing young, feeding, defense, communication, and other factors. Visitor needs include a high-quality environment, parent-child activities, educational programs, entertainment, leisure, interactive experiences, and safety. Administrator needs include park management, animal research, logistical support, animal husbandry, and security.The following four aspects are used to achieve a balance between the three kinds of needs:

### 3.1 Restoration of aquatic ecosystem and water quality maintenance in the waterfowl exhibition area

The three major lakes have poor water quality, and blue-green algae are rampant. To maintain the ecological environment of the exhibition area, a low-carbon and ecologically friendly water ecosystem restoration technology is used for water purification. This technology has been applied in rivers and lakes with low flow rates in non-waterfowl breeding areas. However, the challenge for waterfowl areas is the pollution caused by feed and feces. To solve the problem of large amounts of unconventional pollution sources, a feeding point treatment system is added to the existing technology. From the perspectives of water ecosystem restoration, artificial aeration systems, and feeding point treatment systems, the Three Lakes are transformed into "grassy, clear water" waterfowl lakes.

### 3.2 Controlling the distance between people and waterfowl through landscape method

The original lake area was rigidly separated by railings between people and animals, and the waterfowl activity area was in a captive mode, which needed to be transformed into an ecological display mode and to improve animal welfare. We control the distance between people and waterfowl through two combination modes by studying different waterfowl species. The lake area where pelicans and swans are raised uses a 40cm high upright embankment to prevent waterfowl from going ashore. Meanwhile 60cm high shrubs are planted on the shore to further isolate waterfowl and prevent tourists from approaching the water, leaving a sightseeing space for tourists to avoid crossing the green belt due to poor view; the lake area where flamingos are raised controls the water depth to achieve the purpose of controlling the waterfowl activity range.

### 3.3 Reducing the encroachment into waterfowl's living water area while expanding the visiting space

The original waterside visiting path was narrow, sloping, and affected by tall trees, very few tourists were willing to enter and stay. In the renovation, we adopted an approach that can preserve tall trees and reduce the encroachment into water areas. If the original embankment wall is not demolished, the original tall trees will not fall down. By changing the basic form under the retaining wall, the new embankment can be closely attached to the original retaining wall, and the panel is widened in a cantilevered form to expand the viewing area.

### 3.4 Achieving freedom of movement for waterfowl without affecting the work of administrators

The ability to move freely between the conservation island and the to swim around the lake is a basic welfare requirement for all waterfowl. However, most of the original conservation island was surrounded by high, upright embankment that prevented short-legged waterfowl from perching and breeding. To address this issue, we rebuilt the water gate and raised the position of the spillway to increase the water level and lower the height of the embankment. We also transformed most of the island's embankment into shoal and stairs. Furthermore, the administrator's bridge between the visitor walkway and the conservation island was too close to the water surface, hindering waterfowl from passing through. As a result, we removed the bridge and replaced it with boats to facilitate waterfowl movement around the lake.

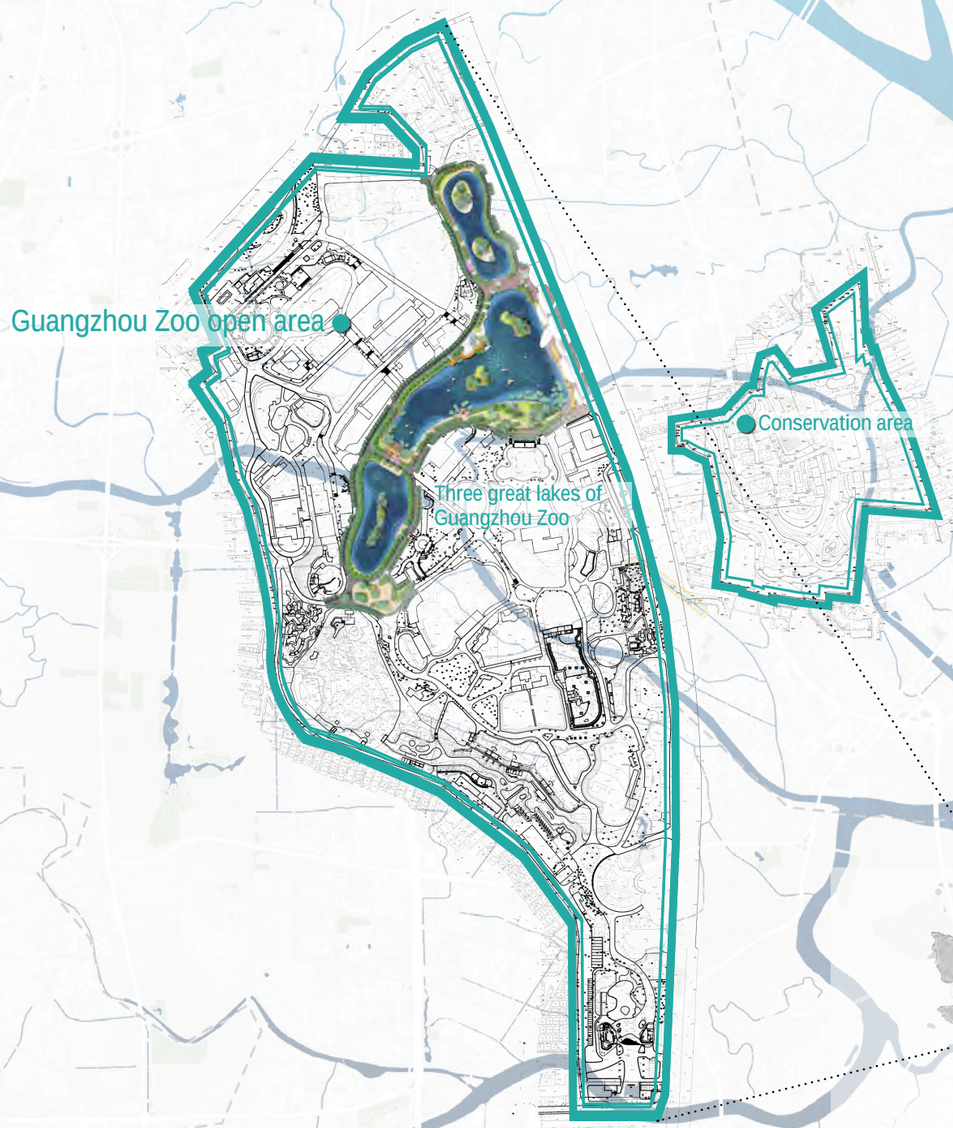
## 4.TEAMWORK

The Guangzhou Zoo is the project's construction unit, and the Shanghai Taihe Water Environmental Technology Development Co., Ltd. is the cooperative unit for aquatic ecological restoration and water quality maintenance, while the Guangzhou Greening Company is responsible for the implementation. Throughout the construction process, each unit maintained close communication and cooperation in their respective fields, providing assistance to the designers in the areas of animal science and water purification technology. The final outcome was satisfactory to both humans and animals.Thank you to some of the photographers:Volunteer Tan Mingzhi,Green company Yang Mengqi,Zhan Xiaowei,Guangzhou Zoo Huang Jiaqi.

# Site Location

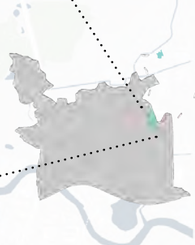
## Guangzhou Zoo is the urban zoo with the largest number of animals and numbers in China. The Three Lakes project is the largest waterfowl exhibition area in the zoo.

Founded in 1958, Guangzhou Zoo has a total area of 42 hectares. Seven years ago, we began to upgrade the animal exhibition area, public environment and management logistics of Guangzhou Zoo step by step. The waterfowl exhibition area of the Three Lakes is our first implementation of the exhibit area project, which is a multi-dimensional ecological waterfowl display area that provides an integration of animal exhibition, protection education, ecological purification and leisure functions. The project takes lots of work in the improvement of water environment, animal welfare and management efficiency, quality and safety of exhibition facilities, also enriched regional plant diversity. It is a meaningful national zoo that represents for the Lingnan region, which enriches the urban biodiversity, strengthens the education in animal conservation.









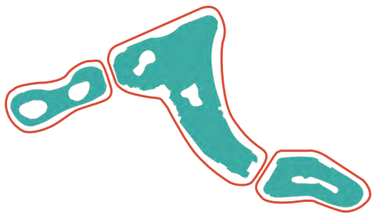


Project Location | Yuexiu District | Guangzhou City | Guangdong Province | China

# Site Conditions

Limited layout

Three lakes



Rounded sightseeing path

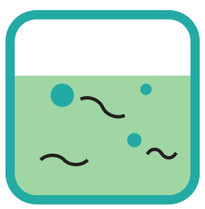
Keynote of Lingnan plant

Comprehensive function

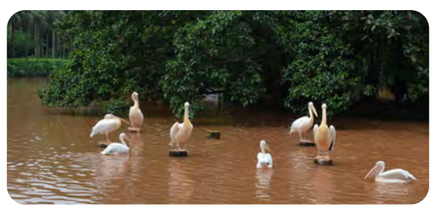
Animal display and popularization of science

Tourist visit

Animal management



Poor water quality



Poor animal living environment

Low breeding rate

Bad tourist visit experience

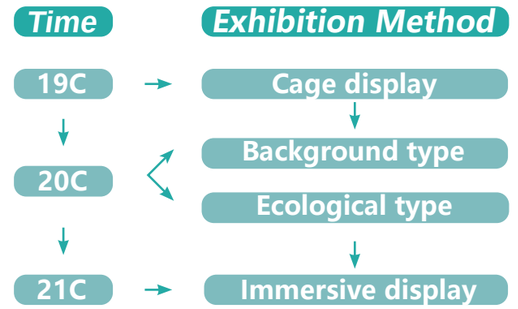
Old and manually operated facilities

Safety hazards

Insufficiency in ecology

Inconsistent with the biological habit of animals

## *Zoo display form development process*




## *Ecological Exhibition*

The project truly improved animal welfare, and realized the exhibition effect of natural science, which is quite rare in China currently.

The Zoo, which has a large number of animal species and quantity,locates in the center of Guangzhou city, so its area cannot expand anymore.Maintaining the existing animal species and number is the obligation and responsibility of the zoo, the overall pattern and animal division can not be changed significantly.

So compared to the immersive exhibition that requires big scale demolition and construction, it is more suitable to adopt ecological exhibition by micro-transformation which can improve human and animal welfare.

## *Project Characteristics*

Since this is a zoo renovation project, planning and construction of the plant community inside and ouside the site is quite fixed, which means it is not appropriate to make major adjustments to the layout. In addition, the zoo is located in the Lingnan area, so the surrounding plants are mainly banyan and Livistona chinensis. The Three Lakes exhibition area adopts mixed breeding, meanwhile provides the functions of animal display, animal protection, and leisure, which is difficult to fully imitate the natural environment of the original habitat for each animal.

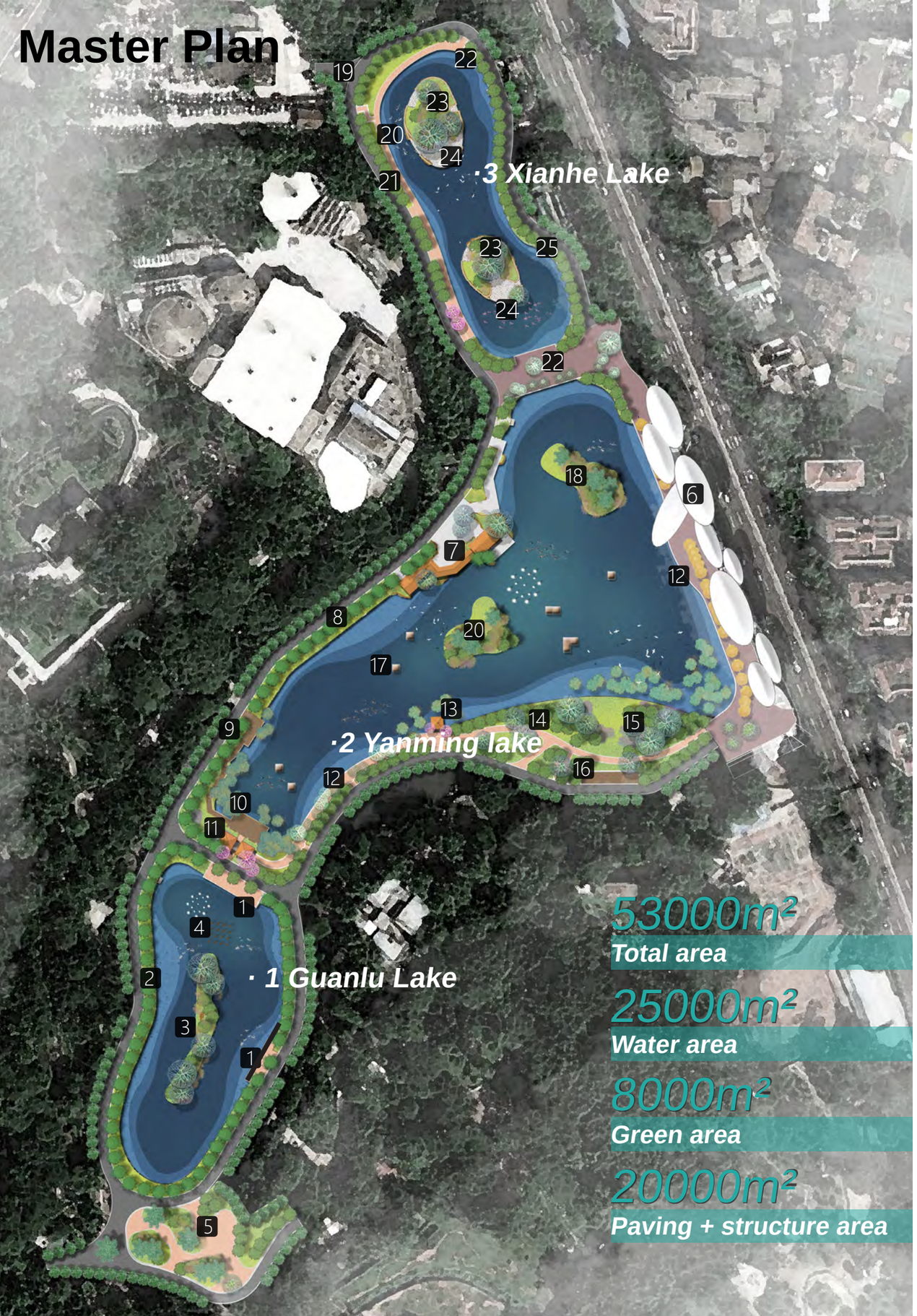
Urban zoo with 60 years of history, the area is limited, and not appropriate to make major adjustments to the layout.

The largest outdoor public leisure area within the Guangzhou Zoo, which also serves as a waterfowl exhibition and recreational facilities.

Poor water quality with rampant blue-green algae, seriously affects the survival and breeding environment of waterfowl and the visit experience of tourists.

**Old facilities that cause safety hazards and insufficiency in** ecology.

# Master Plan




N

5 30

0 15 60m

*1 Guanlu Lake*

1. Waterside deck
2. Green barrier zone
3. Conservation island
4. Roosting stake
5. Palm Square

*2 Yanming lake*

6. Science museum
7. Waterside pergola
8. Green barrier zone
9. Waterside trestle
10. Waterside deck
11. Gloriette
12. Walkway
13. Waterside pergola
14. Forests trails
15. Camellia garden
16. Viewing deck
17. Feeding site
18. Conservation island

*3 Xianhe Lake*

19. Main road
20. Walkway
21. Retaining walls with benches
22. Waterside dec
23. Conservation island
24. Roosting shoal
25. Green barrier zone

## Introduction to the waterbird exhibition area

The Three Lakes is exhibition area for waterfowl and hydrophyte, composed of Guanlu Lake, Yanming Lake and Xianhe Lake, displaying a total of 26 species of self-breeding and wild birds.
On the basis of maintaining the current overall landscape style, the project takes full account of the needs of the administrator, tourists and animals, also keeps the original Lingnan style.We have greatly improved the exhibition environment and animal welfare of the Three Lakes by improving water quality, reorganizing plant area, rebuilding infrastructure, and enhancing the visit experience.

## *1 Guanhe Lake(Main species: pelicans)*

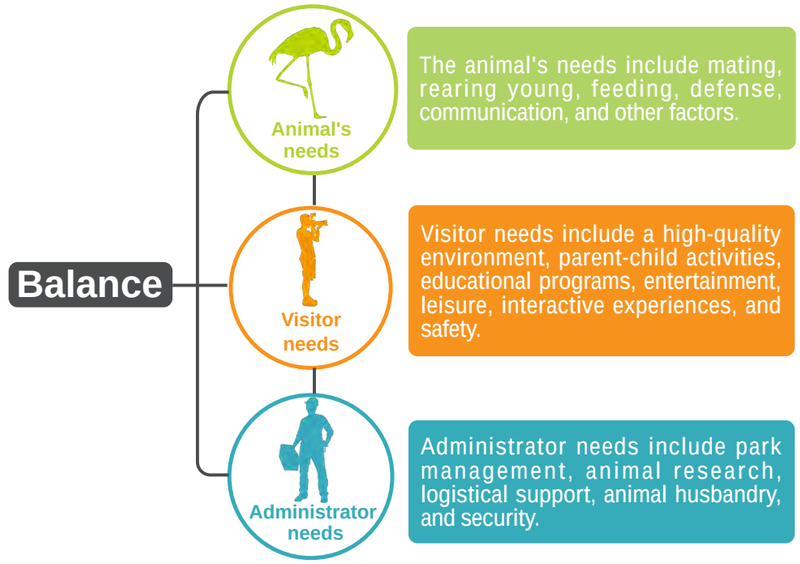
Main species is Pelecanus onocrotalus and Pelecanus rufescens, mixed with Larus argentatus, coexisting with wild Nycticorax nycticorax. Pelicans are good at flying and swimming, and need to be at a distance from visitors.

## *2 Yanming Lake (Main Species:Cygnus)*

Main species is Cygnus atratus, Cygnus olor, Cygnus cygnus, and Cygnus columbianus, mixed with Anser cygnoides, Anser indicus, Balearica regulorum, Gallinula chloropus, and Anas zonorhyncha, coexisting with wild Tachybaptus ruficollis. Swan is friendly to human and often interact with visitors.

## *3 Xianhe Lake (Main Species Phoenicopteridae)*

Main species isPhoenicopterus ruber, which is mixed with Aix galericulata, Tadorna ferruginea, Cygnus melancoryphus, Grus japonensis, Grus vipio, Anthropoides virgo and Tadorna tadorna, coexisting with Centropus sinensis, Gallinula chloropus, Amaurornis phoenicurus and Alcedo atthis. Flamingo waters cannot exceed a depth of 30 centimeters and require a distance from visitors.

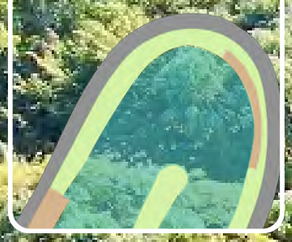


## 1 Guanlu Lake (Pelican Area)

Reduce interaction and improve barriers


**BEFORE**

Concrete gully, ecology **is insufficient**



**AFTER**

Change the gully to the top of the green belt to create a continuous green belt

Continuous green belt

2

Save only prime viewing spots

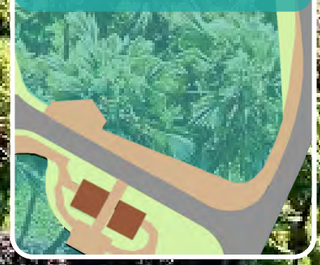
Save only prime viewing spots

Change the original tour path into green

1

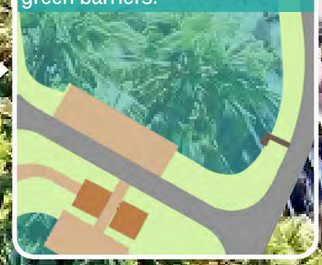
**BEFORE**

The long view disturbed the pelicans.



**AFTER**

Reduce and optimize the visiting space to create more green barriers.



## *2 Yanming Lake (Swan Area)*

Increase interactive spaces between humans and waterfowl

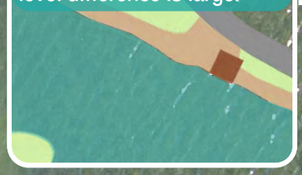
Pavilion protruding water to avoid the way to visit, through each other to stay

**2**

**BEFORE**

1.The visitor path passes through the pavilion, and **the traffic and stay functions** interfere with each other

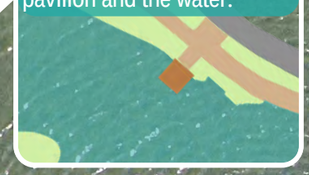
2.Visiting space and water level difference is large.



**AFTER**

1.The new pavilion was built in the water to separate access and stay functions.

2.Narrow the height difference between the pavilion and the water.



The area near the water has a sun shelter

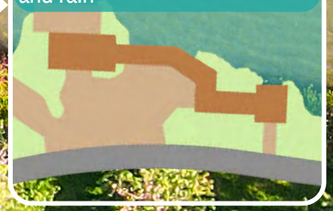
**1**

**BEFORE**

The gallery, built in the middle of the square, is not hydrophilic enough for visitors to interact with the swans in the space of shade from the sun and rain.

**AFTER**

The new corridor is built near the water to enhance hydrophilicity and provide visitors with an interactive space to shade from the sun and rain



# 3 Xianhe Lake (Flamingo Area)

## Limit water depth and reduce interaction

**BEFORE**

Keepers work bridge obstruction
Water birds circle the island and tourists may go on the island to disturb the water birds.

**AFTER**

Remove the bridge and replace it with a pier to prevent tourists from going on the bridge and island.

**BEFORE**

1.The 270° visiting mode **disturbs flamingos.**
2. The water is too deep to limit **the flamingo's range of activity.**

**AFTER**

1, reduce the visiting surface, increase the green barrier.
2.Adjust the water depth to **expand the flamingo's range.**

Add docks for management work

Convert into a shoal

2

Convert into a shoal

Removal of bridge

Removal of bridge

Add steps for water birds to the island

1

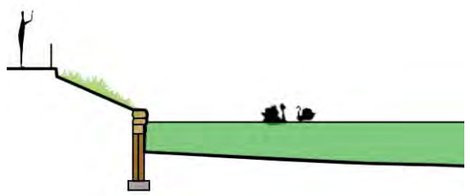
Shallow-water habitat **for flamingos**

Save only prime viewing spots

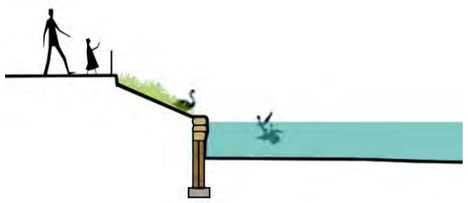
# Problems & Strategies

## Problems

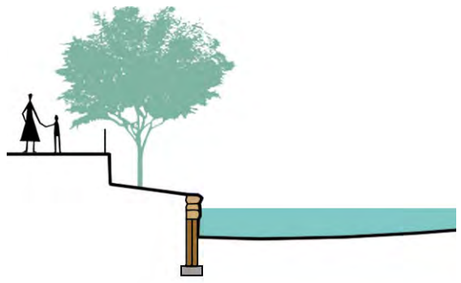
**1** Waterfowl feed and feces continuously pollute water quality of the lake.



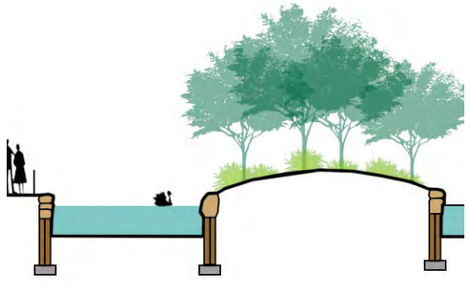
**2** Rigid railings cannot provide safe separation between people and animal.



**3** The original embankment cracks and subsides, big trees on the shore affect the structural safety and passage.

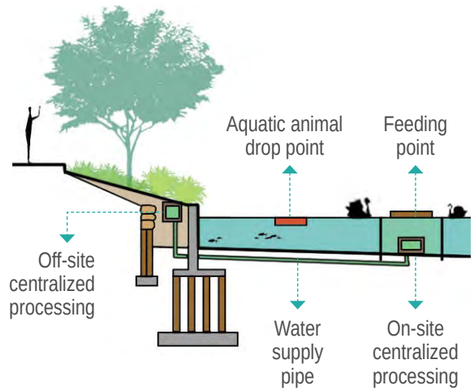


**4** The original embankment on conservation island was too high for waterfowl to get ashore thus prevented them from perching and breeding.The administrator‘s work hinders waterfowl from passing through.

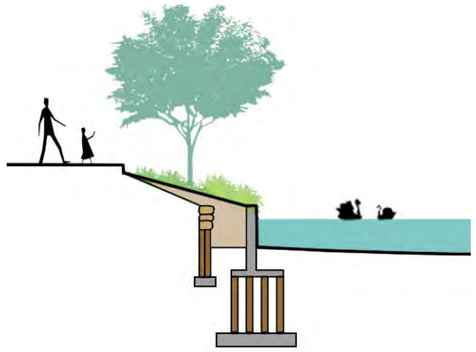


## Strategies

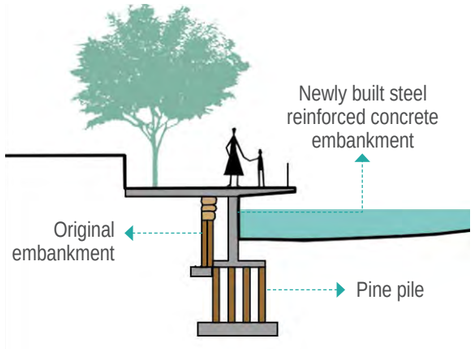
**1** Water restoration and water quality maintenance for the waterfowl exhibition area: improving from **water ecological restoration, artificial** oxygenation system, and feeding point treatment system.



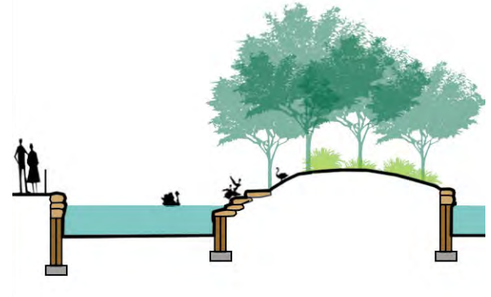

**2** Through studying different waterfowl species, adjust the distance between people and waterfowl through landscape method.



**3** Reducing the encroachment into waterfowl's living water area while expanding the visiting space. Preserving tall trees and reduce the encroachment into water areas by cantilevered embankment which covers the old one.




**4** Achieving freedom of movement for waterfowl without affecting the work of administrators through partial renovation of island revetments, elevation of water levels, and dismantling of connecting bridges.



# Strategies 1.1

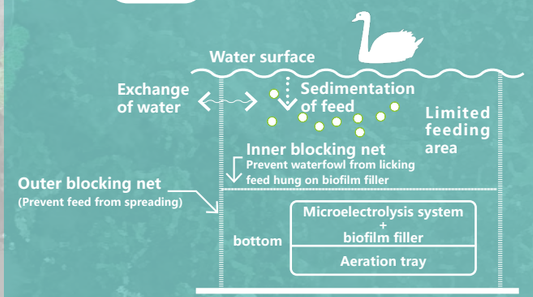
## Restoration of aquatic ecosystem and water quality maintenance in the waterfowl exhibition area

### Special water restoration and water quality maintenance technology

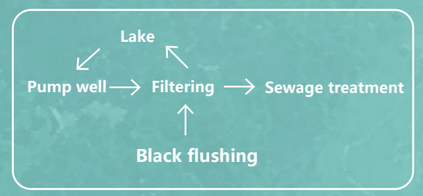
Thanks to the support by Shanghai Taihe Water Environmental Technology Development Co., Ltd.

**Purified water area：** 25363 m²

1. Water restoration
   - Revitalization
     - Photosynthetic bacteria
     - Ammonia oxidizing bacteria
   - Formation of submergent biocenosis by adding
     - Submergent plant
     - Algae eater
     - Aquatic animals
   - Transparency improvement
2. Oxygenation system — Submergent jet Aerator
3. Treatment system on feeding point
   - On-site centralized processing
   - Off-site centralized processing




On-site centralized processing




Off-site centralized processing

## Xianhe Lake

3987 m² *Purified water area*

1.52m *Maximum water depth*

## Yanming lake

15863 m² *Purified water area*

1.53m *Maximum water depth*

## Guanlu Lake

5513 m² *Purified water area*

3.00m *Maximum water depth*

- Revitalization area and region of Submergent plant
- Fountain
- Jet Aerator (Oxygenation)
- On-site centralized processing (Feeding point)
- Off-site centralized processing (Sewage treatment point)

# Strategies 1.2

Restoration of aquatic ecosystem and water quality maintenance in the waterfowl exhibition area

## Key Challenges:

Feed and fecal pollution&Swans destroy submerged plants

## Solution:

Adding a feeding point processing system&increasing of water level

Feeding point processing system
- on site centralized processing system
- off site centralized processing system


Light energy

Feeding site contamination treatment system

Soil layer at the bottom of the lake shall be tidied up and ensure that height of lakeside or submergent hydrophyte do not exceed 50 cm

Egret watching site

Lakeside greenbelt

Hydrophyte

Pelican

Waterfowl

Conservation island

N , P

Algophage

Submerged plant

Fish, shrimp, shellfish, snails

Newly built steel reinforced concrete embankment, stone surface

# Strategies 1.3

- Restoration of aquatic ecosystem and water quality maintenance in the waterfowl exhibition area

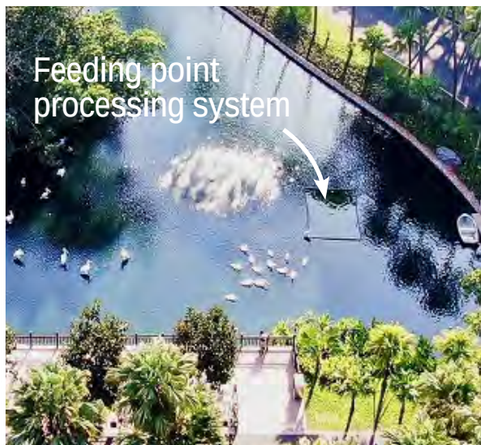
## Biological treatment

**Improving and activating underwater basement, planting submerged plants artificially; Water plants along the revetment;Construct benthic community, and release benthic animals such as shellfish, snails, green shrimp and specific fish.**

## Equipment treatment

**Add aeration system and add feed point treatment system.**



# Strategies 2.1

Controlling the distance between people and waterfowl through landscape method


## Pelican/Swan

+40cm high embankment
+Lakeside hedgerow
+Unblocked view

Plants that do not block sight line

Conservation island

Remove the railing

Renovation of the main park pavement layer

Fine particle asphalt
Middle particle asphalt
Thickened the concrete bed by 8cm

shrubs to prevent waterfowl from getting ashore

Waterfowl

Floating-leaved plant

40cm high embankment

400

Water surface

Newly built steel reinforced concrete embankment

# Strategies 2.2

Controlling the distance between people and waterfowl through landscape method


viewing area become Green belt

The distance between people and flamingos is 20m

Change the water depth and expand the flamingo's range

## Flamingo

+Control water depth to 30cm
+Reduce viewing aspect
+Unblocked sight line

# Strategies 3

## Reducing the encroachment into waterfowl's living water area while expanding the visiting space

1. In order to stabilize the lakeside trees, kept the original retaining wall and built a steel reinforced concrete one.
2. Expanding sightseeing route by cantilevered path
3. By attaching the new and old retaining wall, kept the water surface to high extent
4.Railings are designed according to park standards to improve safety.

Original tree

New railings

Increasing seats

Slope of green

Expanding sightseeing route by cantilevered path

1000

Water surface

Waterfowl

Newly planted emergent plants

Ensure that height of lakeside or submergent hydrophyte do not exceed 50 cm

Newly built steel reinforced concrete embankment

Keeping the original rubble embankment (to prevent original trees from falling)

Concrete bed

Spall bed

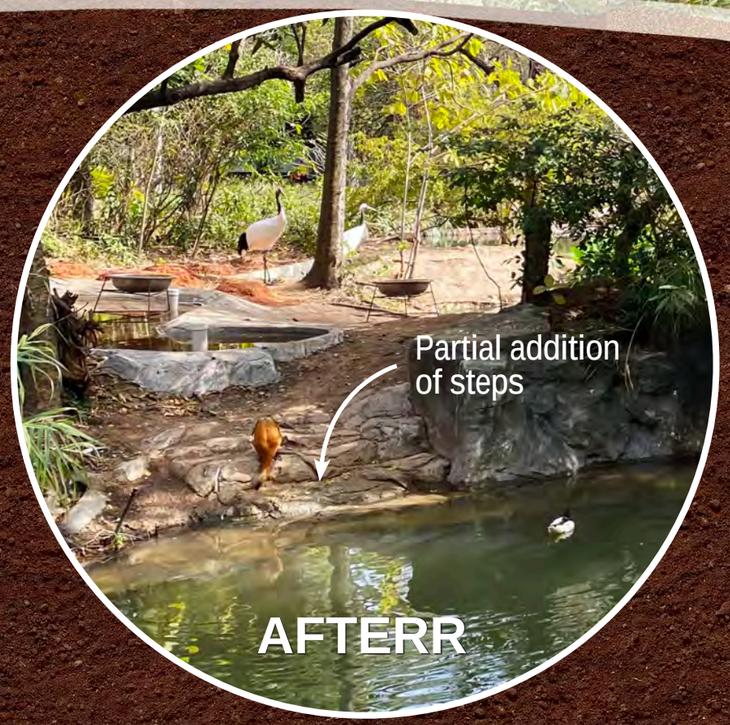
Pine pile

# Strategies 4.1

Achieve the freedom of water birds movement

## Free to get ashore & Increasing welfare

+Upright embankment become ashore
+Partial addition of steps
+Raising the water level and lowering the embankment


Breeding island

Changed into shoal

rebuilt the water gate and increase the water level

easier for short-legged waterfowl to get ashore

Sand bed

Spall bed

Removal of the hard embankment above water surface

New embankment

Keeping the original embankment

# Strategies 4.2

Achieve the freedom of water birds movement


Removal of the work bridge

Steps to the island

Waterfowl route

Waterfowl route

## Free to swim around the island & Balancing administrator and waterfowl welfare

+Removal of the work bridge
+Building a dock to adopt work boat

# Significance 1

## Biodiversity impacts

**Waterfowl in Xianhe lake**

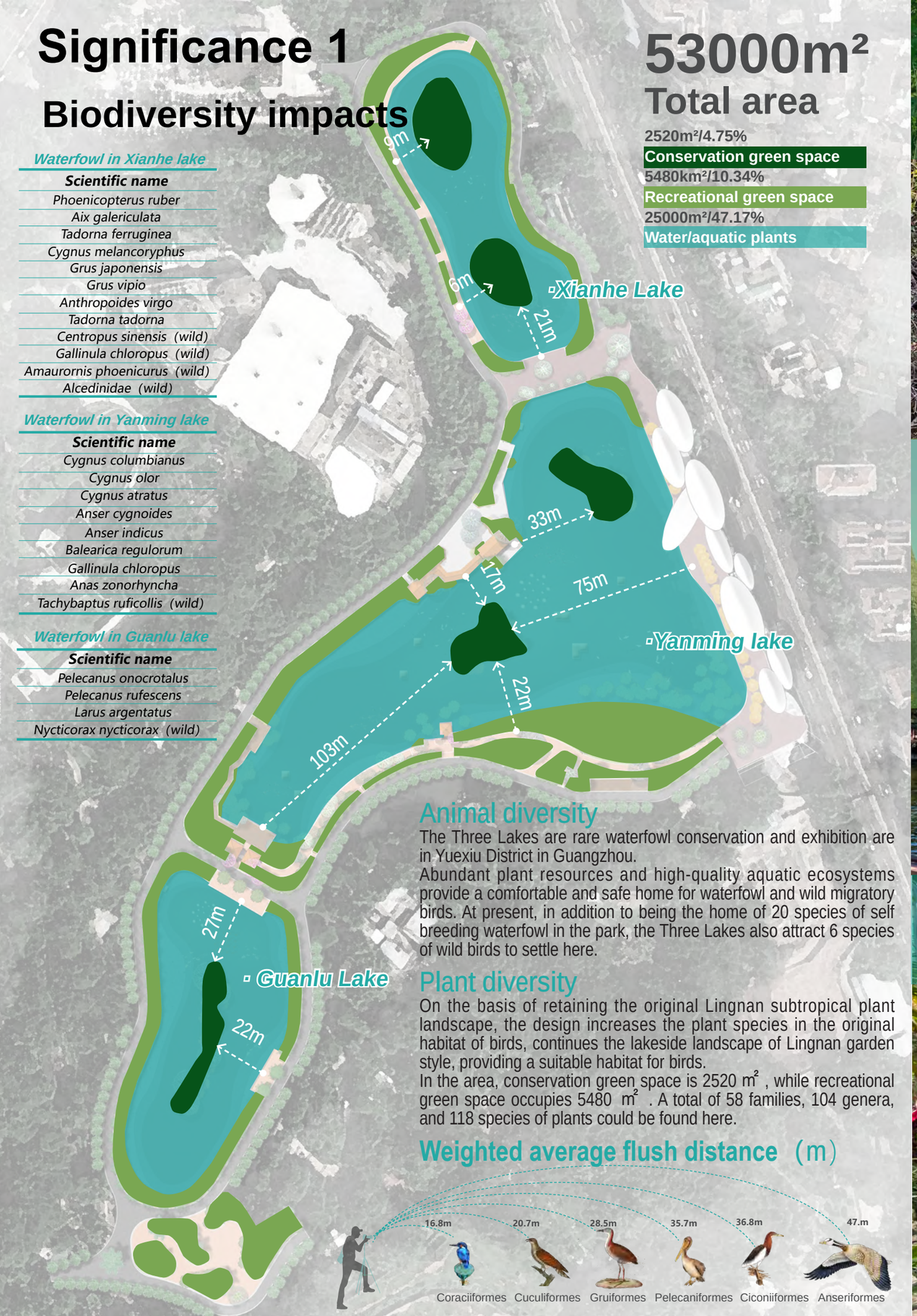
| Scientific name |
|---|
| *Phoenicopterus ruber* |
| *Aix galericulata* |
| *Tadorna ferruginea* |
| *Cygnus melancoryphus* |
| *Grus japonensis* |
| *Grus vipio* |
| *Anthropoides virgo* |
| *Tadorna tadorna* |
| *Centropus sinensis（wild）* |
| *Gallinula chloropus（wild）* |
| *Amaurornis phoenicurus（wild）* |
| *Alcedinidae（wild）* |

**Waterfowl in Yanming lake**

| Scientific name |
|---|
| *Cygnus columbianus* |
| *Cygnus olor* |
| *Cygnus atratus* |
| *Anser cygnoides* |
| *Anser indicus* |
| *Balearica regulorum* |
| *Gallinula chloropus* |
| *Anas zonorhyncha* |
| *Tachybaptus ruficollis（wild）* |

**Waterfowl in Guanlu lake**

| Scientific name |
|---|
| *Pelecanus onocrotalus* |
| *Pelecanus rufescens* |
| *Larus argentatus* |
| *Nycticorax nycticorax（wild）* |




# 53000m²

## Total area

2520m²/4.75%

**Conservation green space**

5480km²/10.34%

**Recreational green space**

25000m²/47.17%

**Water/aquatic plants**

## Animal diversity

The Three Lakes are rare waterfowl conservation and exhibition are in Yuexiu District in Guangzhou.
Abundant plant resources and high-quality aquatic ecosystems provide a comfortable and safe home for waterfowl and wild migratory birds. At present, in addition to being the home of 20 species of self breeding waterfowl in the park, the Three Lakes also attract 6 species of wild birds to settle here.

## Plant diversity

On the basis of retaining the original Lingnan subtropical plant landscape, the design increases the plant species in the original habitat of birds, continues the lakeside landscape of Lingnan garden style, providing a suitable habitat for birds.
In the area, conservation green space is 2520 m² , while recreational green space occupies 5480 m² . A total of 58 families, 104 genera, and 118 species of plants could be found here.

## Weighted average flush distance （m）

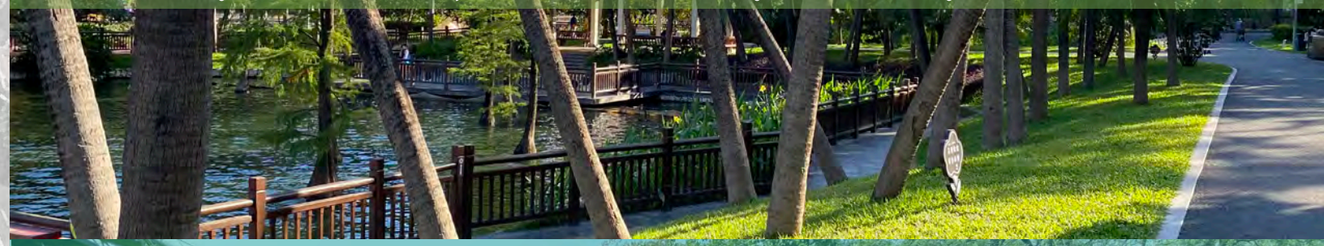



## Plants in the conservation green space

*Ficus altissima*
*Ficus microcarpa*
*Ficus virens*
*Ficus hispida*
*Broussonetia papyrifera*
*Triadica sebifera*
*Ilex rotunda*
*Plumeria rubra*
*Syzygium jambo*
*Syzygium samarangense*
*Celtis sinensis*
*Bougainvillea spectabilis*
*Elaeocarpus hainanensis*
*Ligustrum sinense*
*Roystonea regia*
*Livistona humilis*
*Dypsis lutescens*
*Archontophoenix alexandrae*
*Cenchrus setaceus 'Rubrum'*
*Cyperus involucratus*
*Cyperus involucratus*
*Reineckea carnea*
*Daphne odora 'Aureomarginata'*
*Thaumatophyllum bipinnatifidum*
*Alocasia odora*
*Fagraea ceilanica*
*Hymenocallis littoralis (Jacq.) Salisb.*

## Plants in the recreational green space

*Ficus elastica*
*Codiaeum variegatum*
*Plumeria rubra*
*Catharanthus roseus*
*Syzygium hainanense*
*Syzygium nervosum*
*Xanthostemon chrysanthus*
*Melaleuca cajuputi subsp. cumingiana*
*Melaleuca bracteata 'Revolution Gold'*
*Eugenia uniflora*
*Callistemon viminalis*
*Yulania × soulangeana*
*Heteropanax fragrans*
*Heptapleurum chapanum*
*Dracontomelon duperreanum*
*Bauhinia variegata*
*Bauhinia × blakeana*
*Bauhinia tomentosa*
*Delonix regia*
*Cassia bakeriana*
*Calliandra haematocephala*
*Ravenala madagascariensis*
*Casuarina equisetifolia*
*Calliandra haematocephala*
*Ravenala madagascariensis*
*Casuarina equisetifolia*
*Dimocarpus longan*
*Ceiba speciosa*
*Osmanthus fragrans 'Semperflorens'*
*Livistona chinensis*
*Phoenix sylvestris*
*Phoenix dactylifera*
*Arenga tremula*
*Rhapis excelsa*
*Rhapis gracilis*
*Bambusa multiplex var. riviereorum*
*Phyllostachys sulphurea var. viridis*
*Arrhenatherum elatius var. bulbosum f. variegatum*
*Axonopus compressus*
*Zoysia matrella*
*Lagerstroemia indica*
*Mussaenda erythrophylla*
*Rondeletia leucophylla*
*Gardenia jasminoides var. fortuneana*
*Dianella tasmanica 'Variegata'*
*Loropetalum chinense var. rubrum*
*Ruellia simplex*
*Dracaena marginata 'Tricolor*
*Rainbow'Loropetalum chinense var. rubrum*
*Ruellia simplex*
*Dracaena marginata 'Tricolor*
*Rainbow'*
*Asparagus cochinchinensis*
*Ophiopogon japonicus*
*Agave americana*
*Combretum indicum*
*Terminalia neotaliala*
*Murraya exotica*
*Camellia japonica*
*Holmskioldia sanguinea*
*Clerodendrum speciosissimum*
*Breynia disticha*
*Podranea ricasoliana*
*Crescentia alata*
*Curculigo capitulata*
*Hellconia subulata*
*Pilea cadierei*
*Spathiphyllum floribundum 'Clevelandii'*
*Alpinia zerumbet*
*Aucuba japonica var. variegata*



## Hydrophyte

*Taxodium distichum*
*Phragmites australis*
*Arundo donax 'Versicolor'*
*Cortaderia selloana 'Pumila'*
*Canna glauca*
*Iris ensata*
*Iris wilsonii*
*Lythrum salicaria*
*Cyperus papyrus*
*Thalia dealbata*
*Vallisneria natans*
*Vallisneria spinulosa*
*Najas minor*

# Significance 2

## Conservation education impacts

### Science popularization and interactive facilities

+ Science popularization board on retaining wall, which is combined with the image of main display animals

**+ Adding specific science popularization content**

+ Intuitive and interesting display effects are achieved