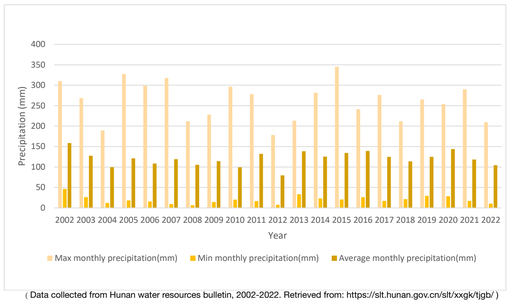
Overview of Xiangjiang River

01 Project background

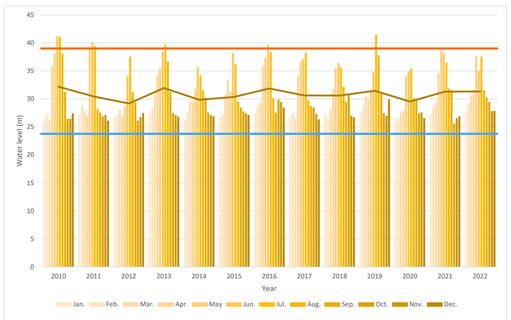
The Xiangjiang River has been an important branch of the Yangtze River since ancient times. It originates in southern Hunan Province and flows through 8 cities for 969 kilometers before empting into Dongting Lake. Due to soil erosion in the upper reaches of the Yangtze River and a sharp reduction in the area of Dongting Lake, sediment accumulation in the river channel has resulted in floods for years.
In addition, the annual flood season, the influence of El Nino phenomenon, and the increase of melt water on the Qinghai-Tibet Plateau caused by global warming are all reasons contributing to flood disaster in the Xiangjiang River region. People are starting to realize that. Therefore, strong measures are necessary to reduce the impacts of flooding events.

02 Annual precipitation over the last 20 years



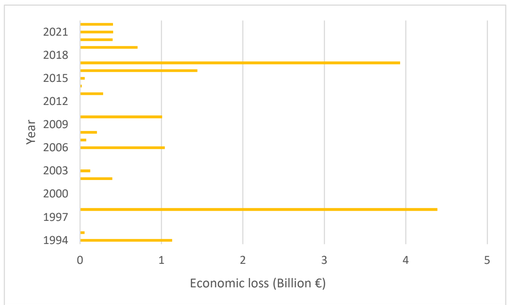
(Data collected from Hunan water resources bulletin, 2002-2022. Retrieved from: https://slt.hunan.gov.cn/slt/xxgk/tjgb/)

03 Variation of water level of Xiangjiang River in Xiangtan

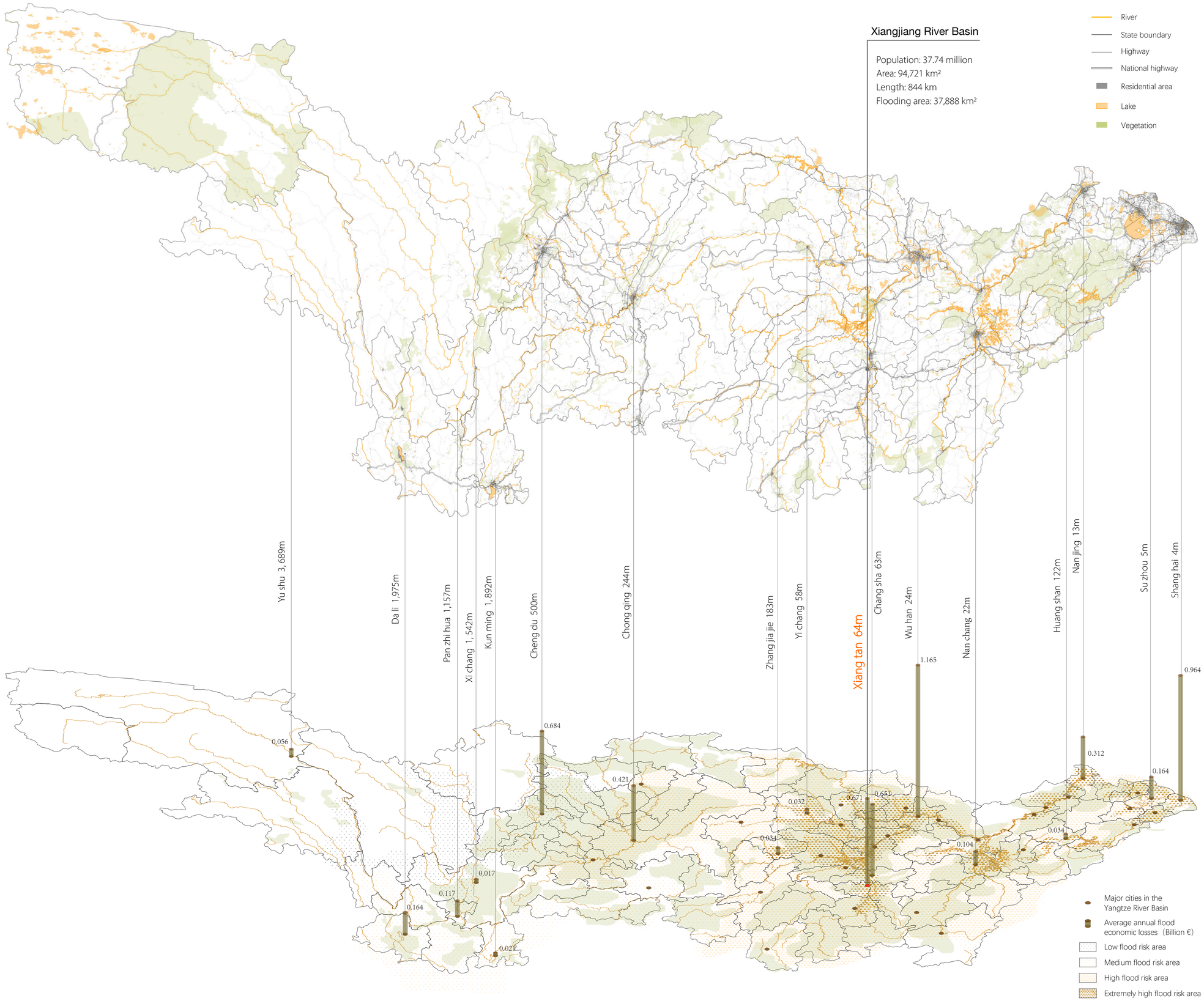


(Data collected from Hunan water resources bulletin, 2010-2022. Retrieved from: https://slt.hunan.gov.cn/slt/xxgk/tjgb/)

04 Annual economic losses caused by floods in Xiangtan area

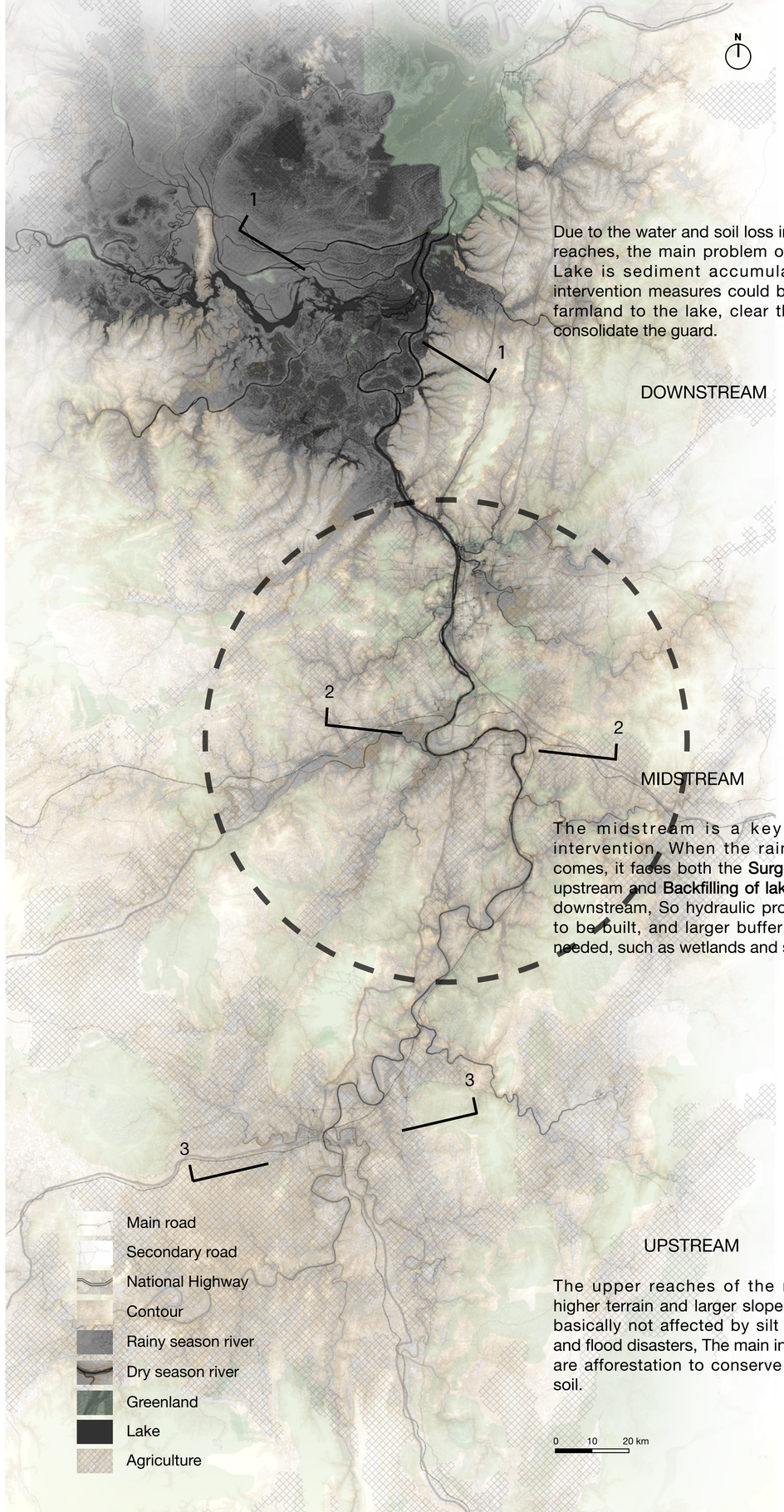


(Data collected from: https://sdaj.hunan.gov.cn/sdaj/dayw_78261/index.html.)



THE STRUGGLE AGAINST XIANGJIANG RIVER FLOOD

Through the analysis of river sections, it is found that the upper, middle and lower reaches of Xiangjiang River basin contain 3 different waterway landscapes because of the different sediment content of the river, which are natural channels, sand-bar channels and lake-type channels. The downstream near Dongting Lake is buffered by vast wetlands and swamps, while the upper mountain area rarely floods, and the middle reaches are flat and easily affected by floods, so the thesis mainly addresses the middle reaches.



Due to the water and soil loss in the upper reaches, the main problem of Dongting Lake is sediment accumulation. The intervention measures could be to return farmland to the lake, clear the silt and consolidate the guard.

DOWNSTREAM

MIDSTREAM

The midstream is a key area for intervention. When the rainy season comes, it faces both the **Surge of rain** in upstream and **Backfilling of lake water** in downstream, So hydraulic projects need to be built, and larger buffer zones are needed, such as wetlands and swamps.

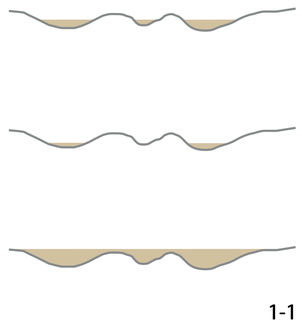
UPSTREAM

The upper reaches of the river have higher terrain and larger slope, which are basically not affected by silt deposition and flood disasters, The main interventions are afforestation to conserve water and soil.

RIVER SECTION

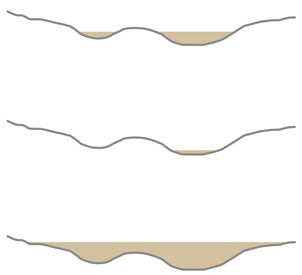
DIFFERENT TYPES OF CHANNELS IN DIFFERENT SEASONS

Lake-type channels



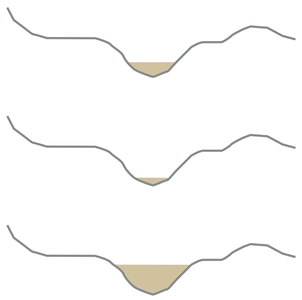
1-1

Sand-bar channels

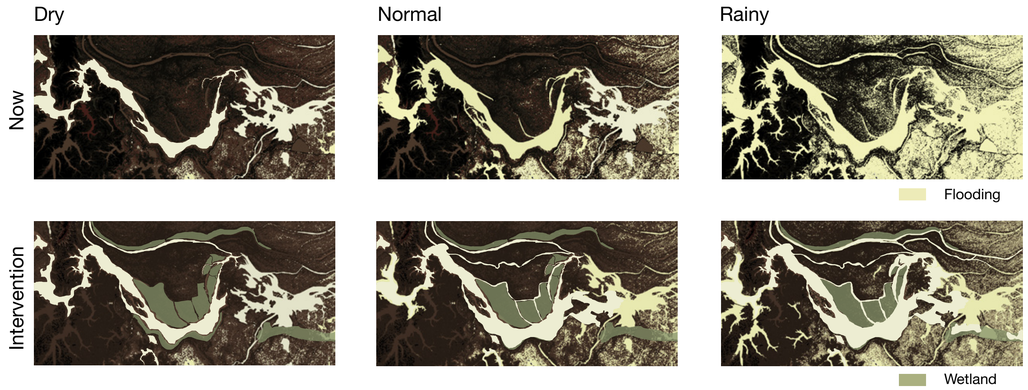


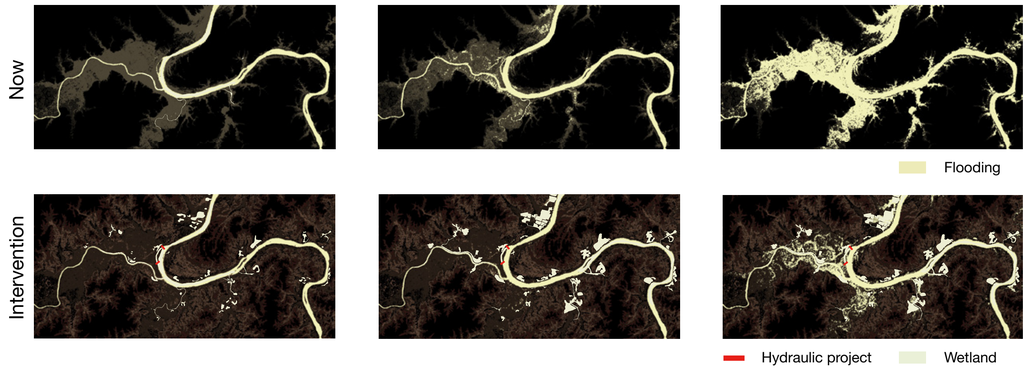
2-2

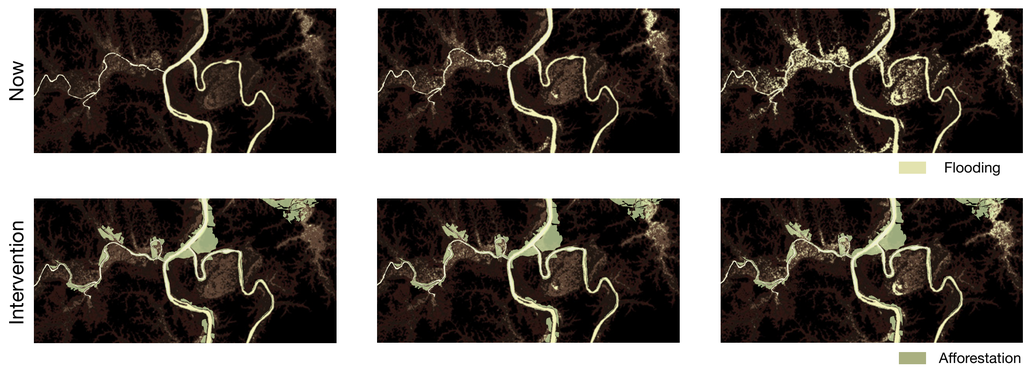
Natural channels



3-3



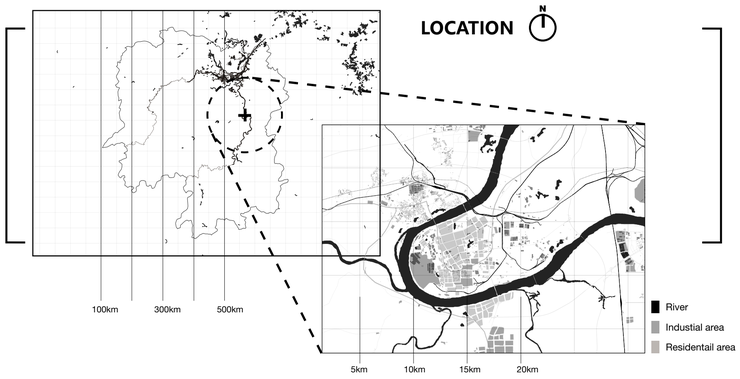




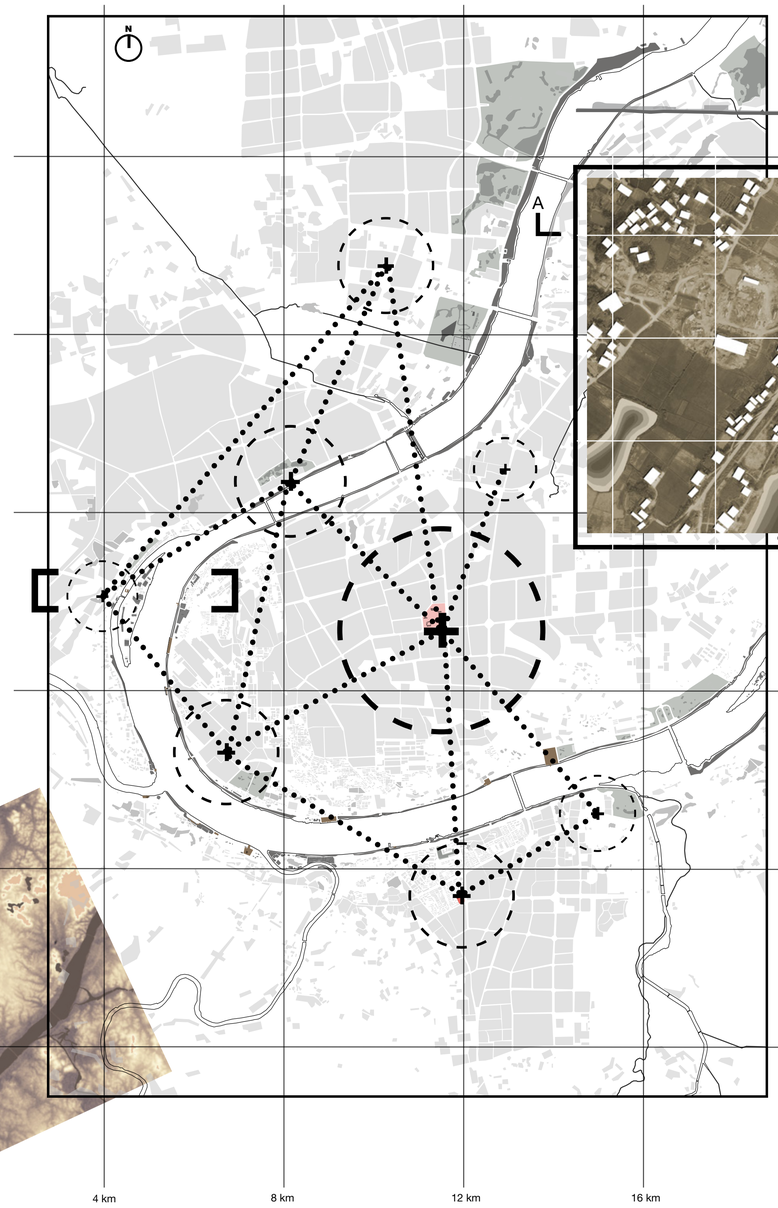
SITE ANALYSIS

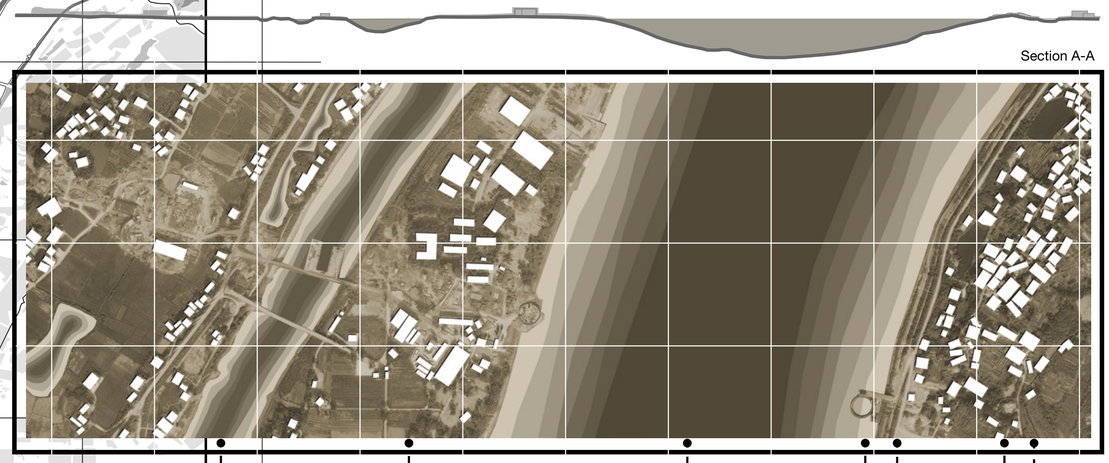
Xiangtan, located in the middle reaches of the Xiangjiang River in southern China, is an important economic and industrial city in Hunan. The land use of Xiangtan section of Xiangjiang River is mainly divided into residential area, industrial area, farmland and tidal flat.





THE SITE



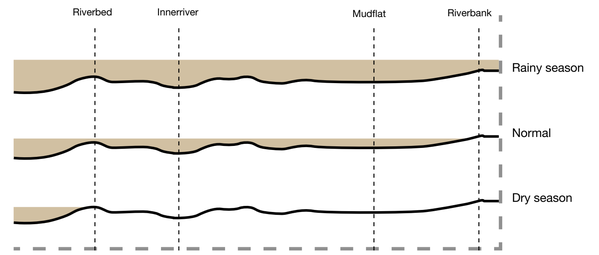


LEGEND

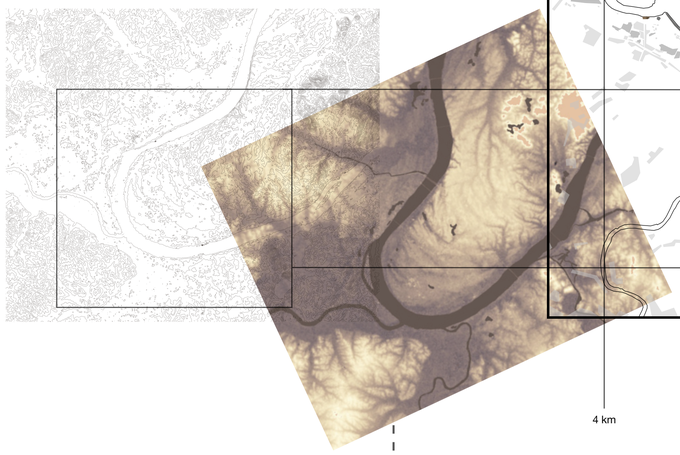
- Town center
- Populated area
- Blocks
- Wetland
- Mudflat
- Wetland
- Municipality
- Wharf
- Landscape axis

SUBMERSION IN TIMELINE

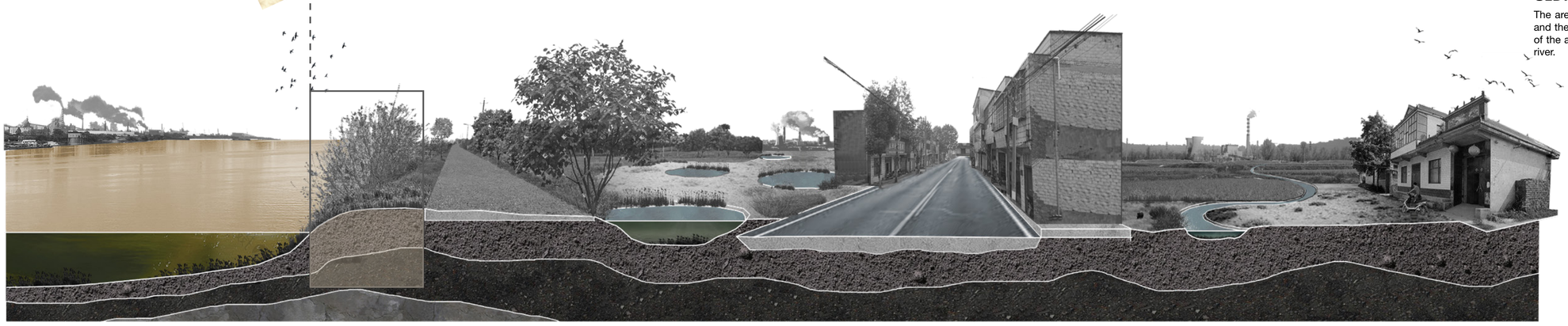
The annual rainy season brings a water level drop of 15 to 20 meters to the Xiangjiang River.



·Xiangtan Section of Xiangjiang River is located in the 'S' shaped channel. The velocity of the river slows down and sediments tend to deposit easily here. Therefore, there are many sandbanks, such as Yangmei Island and Gusang Island.

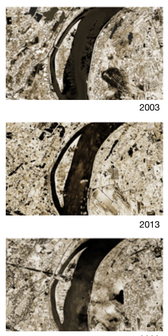


·The riverbanks in Xiangtan section of Xiangjiang River are in undeveloped or semi-developed state, especially in rural areas, which are generally in a natural state, so their resilience towards floods is poor.



SEDIMENT DEPOSITION PROCESS

The area of Yangmei Island is increasing day by day, and the highest water level is also increasing because of the accumulation of sediment on the bottom of the river.



MASTERPLAN

For such a changeable site, multi-dimensional landscape design is necessary. Highly resistant plants and associated artificial equipment help reduce the impact of unstable water levels on the ecology of the site.

Consolidation: Strengthen the resilient design of riverbank flood control

3
Wetland parks

224.2
hectares of new greenery to coping with flooding

Domestic context
of resting and feeding for plants and species

109,758.6
tons of CO2 less in the environment

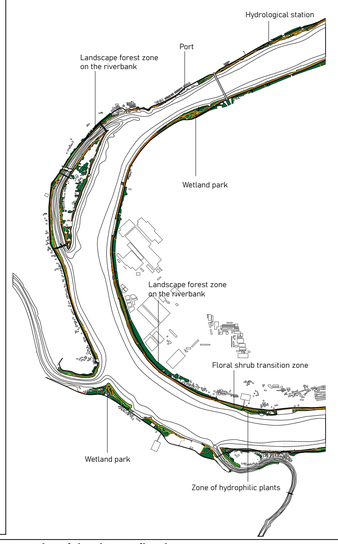
29+
species benefit, including plants, aquatic animals and birds

37,000
visit per day

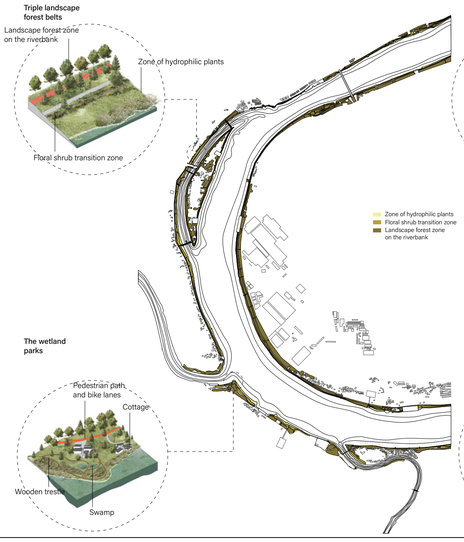
35.5
km of Landscape roads will be built

1.73
billion euros of potential economic growth

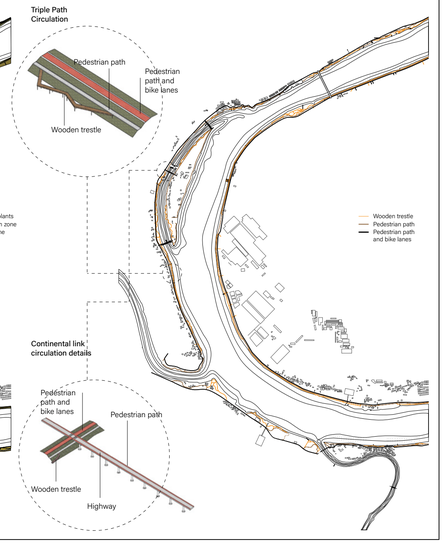
Resilient design of riverbank



Resilient landscape corridor



Flood control device



Dredging: to improve the capacity of the river to flood

12
Swamp or ponds

2
Small hydroelectric power station

134.21
hectares of water area

4,100,000
tons more water for flood capacity

3.5
Billion kWh max electricity output per year

40
tons of fish output per hectare annually

100+
jobs offered

80%
Reduction of flood area

1,052
Ktons less of coal burning per year

Drainage and storage design

Wetland design of riverbank

Inner river dam design

Early warning: Reasonable early warning mechanism and safe zone

18
Plaza or grounds

3
Beaches for entertainment

4.74
hectares of safe zone for flood

90
Bladeless Vortexers

144,000
kWh max electricity output per year

15
Water level alarms

1200+
4m*4m disaster relief tents can be placed

3600+
Refugees can be resettled

5
million euros economic losses reduced per year

Distribution of Plaza and alarm devices

Details of Plaza

Bladeless Vortexers with water level alarms

RESILIENT DESIGN OF RIVERBANK

Aerial view

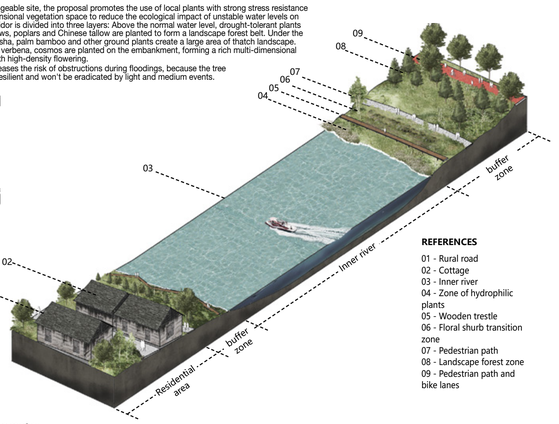
RESILIENT LANDSCAPE CORRIDOR

Enhancement

In view of such a changeable site, the proposal promotes the use of local plants with strong stress resistance to create a multi-dimensional vegetation space to reduce the ecological impact of unstable water levels on the site.The plant corridor is divided into three layers: Above the normal water level, drought-tolerant plants such as weeping willows, poplars and Chinese tallow are planted to form a landscape forest belt. Under the normal water level, pasha, palm bamboo and other ground plants create a large area of thatch landscape. Finally, plants such as verbena, cosmos are planted on the embankment, forming a rich multi-dimensional planting landscape with high-density flowering.

Being resilient, it decreases the risk of obstructions during floodings, because the tree species selected are resilient and won't be eradicated by light and medium events.

Location

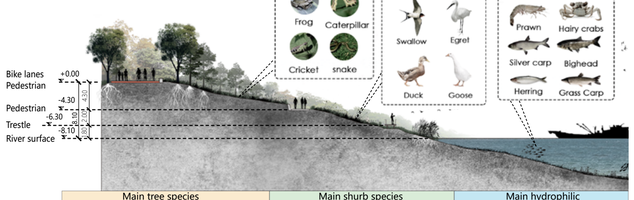


Axonometry

REFERENCES

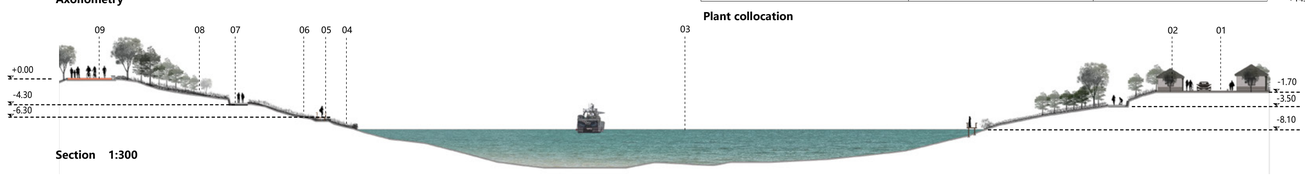
01 - Rural road
02 - Cottage
03 - Inner river
04 - Zone of hydrophilic plants
05 - Wooden trestle
06 - Floral shurb transition zone
07 - Pedestrian path
08 - Landscape forest zone
09 - Pedestrian path and bike lanes

Construction detail

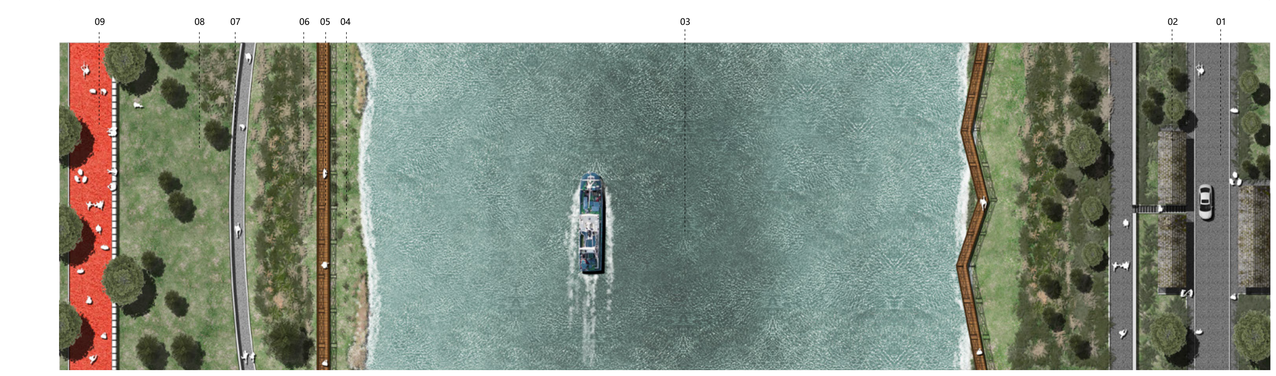


Main tree species			Main shurb species			Main hydrophilic		
Platycladus orientalis	Robinia pseudoacacia L	Sapium sebiferum (L.) Roxb.	Cosmos bipinnatus	Echeveria 'Perle von Nürnberg'	Cosmos bipinnatus	Rhapis excelsa	Canna generalis	Miscanthus
Salix babylonica L	Populus alba L	Taxodium ascendens	Coreopsis grandiflora Hogg.	Hemerocallis fulva L.	Iris tectorum	Verbena officinalis	Cyrtococcum patens (L) A. Camus.	Cortaderia selloana

Plant collocation



Section 1:300



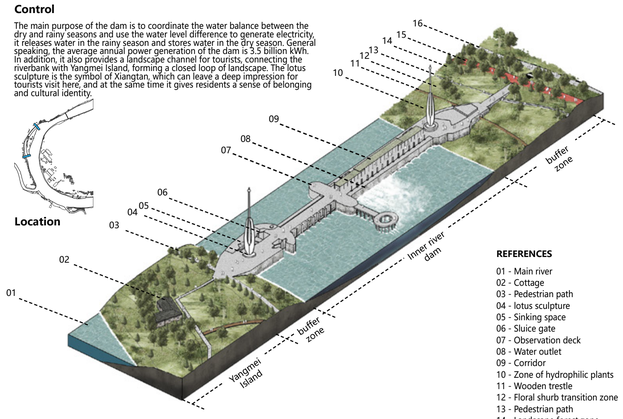
Plan 1:300

INNER RIVER DAM DESIGN

Control

The main purpose of the dam is to coordinate the water balance between the dry and rainy seasons and use the water level difference to generate electricity, it releases water in the rainy season and stores water in the dry season. General speaking, the average annual power generation of the dam is 3.5 billion kWh. In addition, it also provides a landscape channel for tourists, connecting the riverbank with Yangmei Island, forming a closed loop of landscape. The lotus sculpture is the symbol of Xiangtan, which can leave a deep impression for tourists visit here, and at the same time it gives residents a sense of belonging and cultural identity.

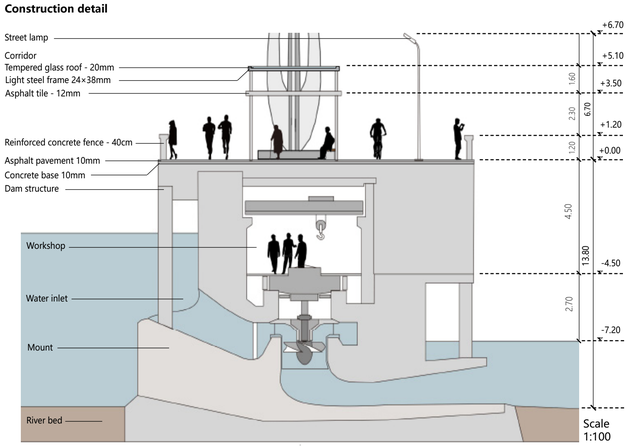
Location

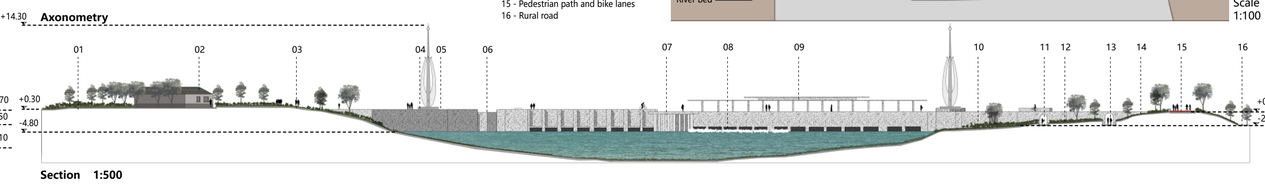


REFERENCES

01 - Main river
02 - Cottage
03 - Pedestrian path
04 - lotus sculpture
05 - Sinking space
06 - Sluice gate
07 - Observation deck
08 - Water outlet
09 - Corridor
10 - Zone of hydrophilic plants
11 - Wooden trestle
12 - Floral shurb transition zone
13 - Pedestrian path
14 - Landscape forest zone
15 - Pedestrian path and bike lanes
16 - Rural road

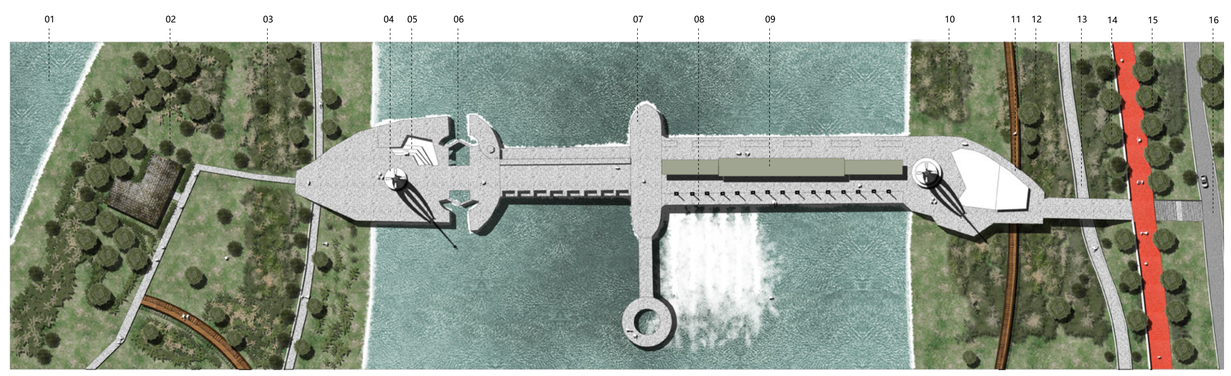
Construction detail





Axonometry

Section 1:500



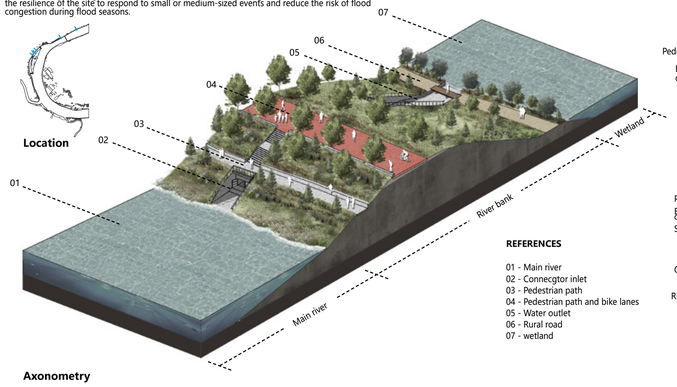
Plan 1:500

RESILIENT DESIGN OF RIVERBANK

Attention: The proposal is made to create spaces that having their own purpose and identity, it can also help to reduce the possible impacts of floodings in those areas. It will not be used for other purposes in the future (such as illegal settlements and high-risk agricultural uses).

WETLAND DESIGN

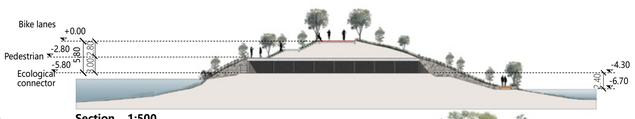
The wetland consists of a newly built artificial lake and natural water system connected to the Xiangjiang River by an ecological channel, which is used to regulate the change of water level on both sides of the river bank, and it stores water during the rainy season to reduce the pressure of floods.
Like the ecological design of riverbanks, the purpose of constructing artificial wetlands is to increase the resilience of the site to respond to small or medium-sized events and reduce the risk of flood congestion during flood seasons.



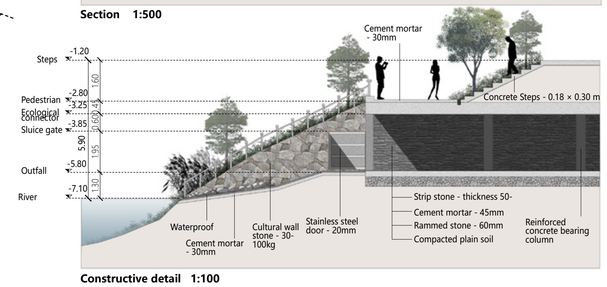
Axonometry

REFERENCES

01 - Main river
02 - Connecgtor inlet
03 - Pedestrian path
04 - Pedestrian path and bike lanes
05 - Water outlet
06 - Rural road
07 - wetland



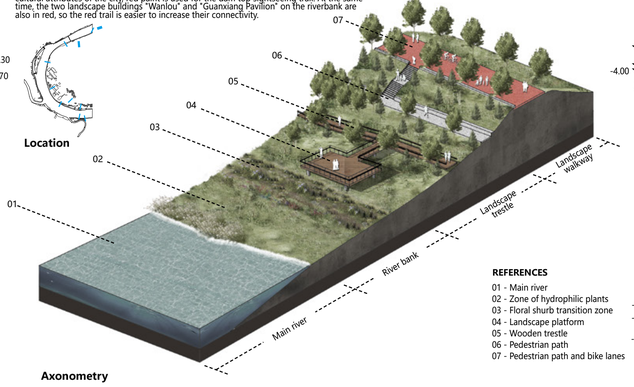
Section 1:500



Constructive detail 1:100

FLOOD CONTROL DEVICES

The artificial installation is designed to enhance the self-reinforcement of the site and minimize its interference. Three footpaths with different elevations have been built to meet the activities and viewing needs of citizens at different water levels. They are the dam top sightseeing trail, the dam multi-functional experimental area and the swamp trail. Walkway is built with waterproof materials, and the overhead structure provides sufficient growth space.
It is worth noting that Xiangtan is the cradle of red culture (communism), so to increase the cultural attributes of the city, red paint is used for the dam top sightseeing trail. At the same time, the two landscape buildings "Wanlou" and "Guanxiang Pavilion" on the riverbank are also in red, so the red trail is easier to increase their connectivity.

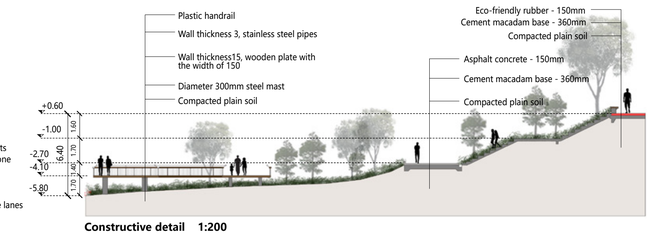


Axonometry

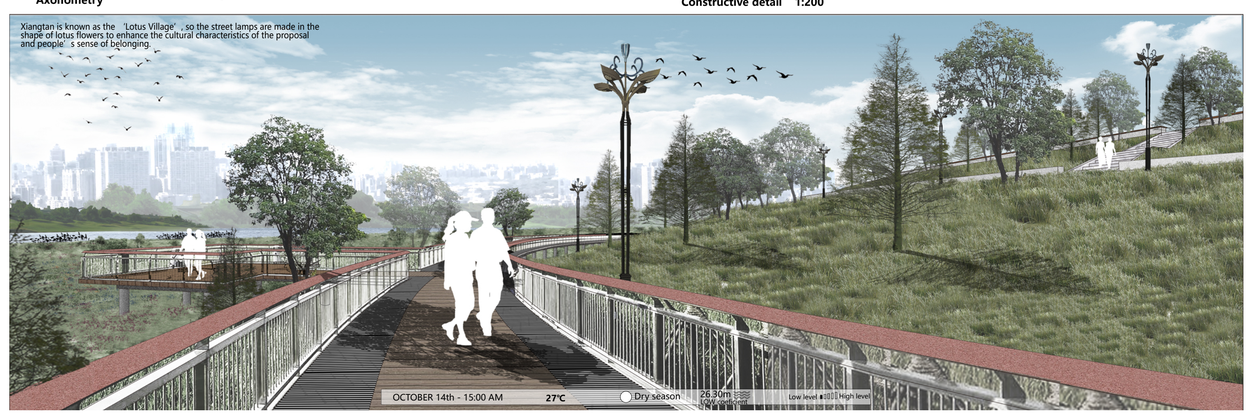
REFERENCES

01 - Main river
02 - Zone of hydrophilic plants
03 - Floral shurb transition zone
04 - Landscape platform
05 - Wooden trestle
06 - Pedestrian path
07 - Pedestrian path and bike lanes

Section 1:500

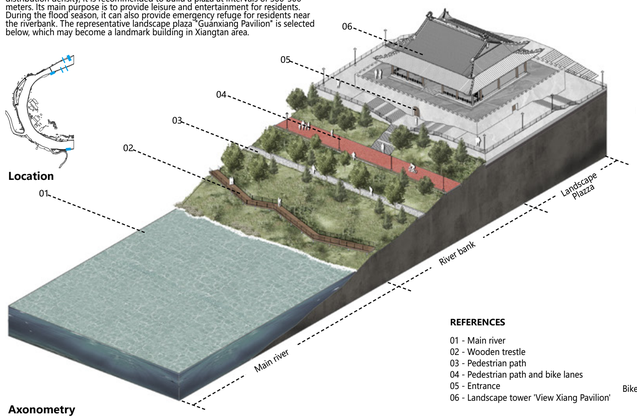


Constructive detail 1:200



LANDSCAPE PLAZA

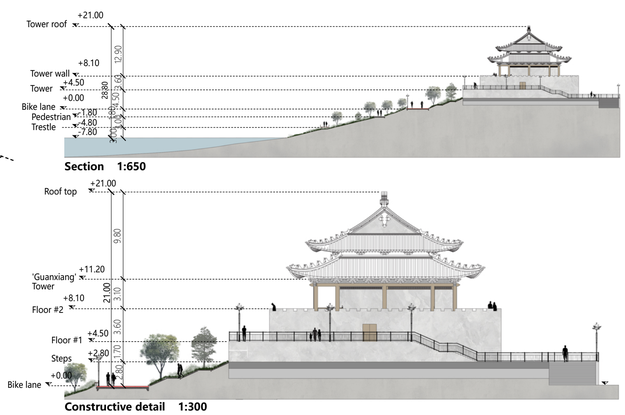
The landscape plazas are distributed along the river. According to the population distribution density, it is recommended to build a plaza at intervals of 300-500 meters. Its main purpose is to provide leisure and entertainment for residents. During the flood season, it can also provide emergency refuge for residents near the riverbank. The representative landscape plaza "Guanxiang Pavilion" is selected below, which may become a landmark building in Xiangtan area.



Axonometry

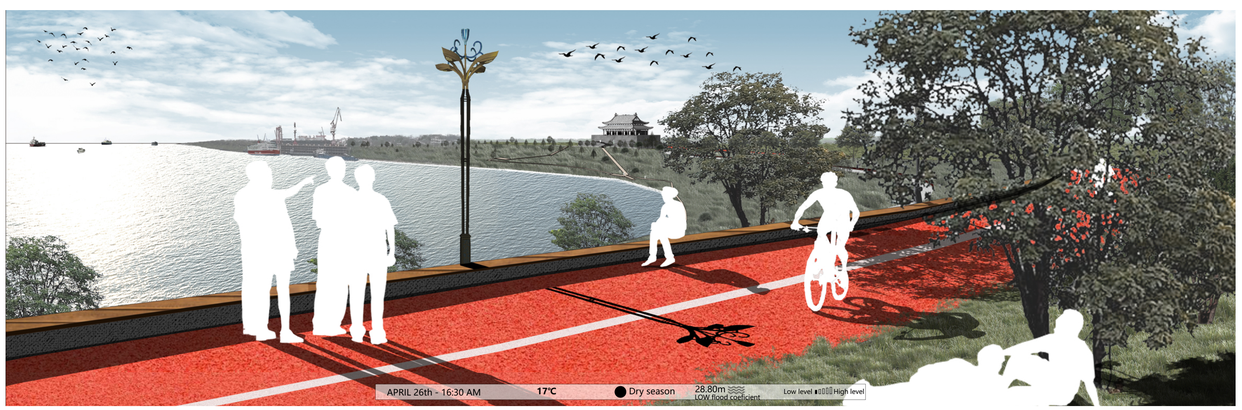
REFERENCES

01 - Main river
02 - Wooden trestle
03 - Pedestrian path
04 - Pedestrian path and bike lanes
05 - Entrance
06 - Landscape tower 'View Xiang Pavilion'



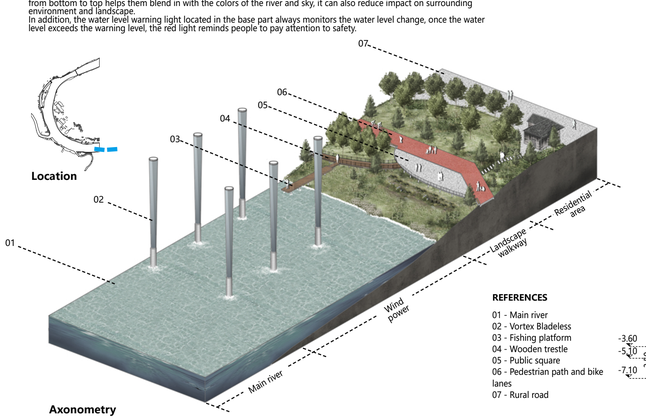
Section 1:650

Constructive detail 1:300



WIND ENERGY & ALARM DEVICES

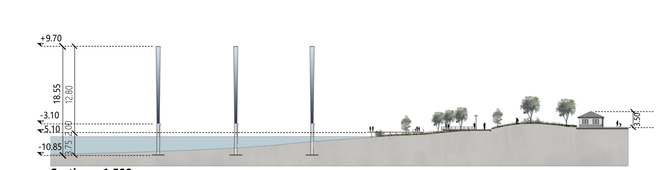
The project uses bladeless turbines, a new power generation technology that is low maintenance and harmless to wildlife, so they open up new horizons for wind energy in urban areas and protected areas. The appearance of blue gradient color from bottom to top helps them blend in with the colors of the river and sky, it can also reduce impact on surrounding environment and landscape.
In addition, the water level warning light located in the base part always monitors the water level change, once the water level exceeds the warning level, the red light reminds people to pay attention to safety.



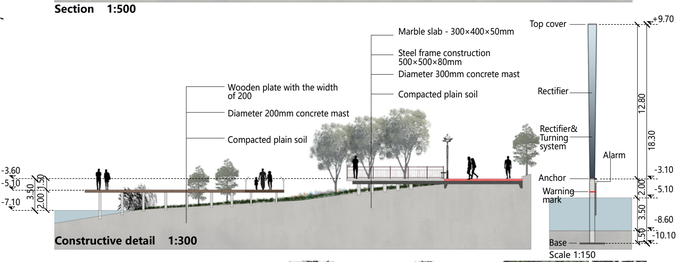
Axonometry

REFERENCES

01 - Main river
02 - Vortex Bladeless
03 - Fishing platform
04 - Wooden trestle
05 - Public square
06 - Pedestrian path and bike lanes
07 - Rural road



Section 1:500



Constructive detail 1:300