WATER RESILIENT AND ADAPTIVE DEVELOMENT OF PAZHOU ISLAND

Pearl River Delta Graduation Lab
P5 Presentation

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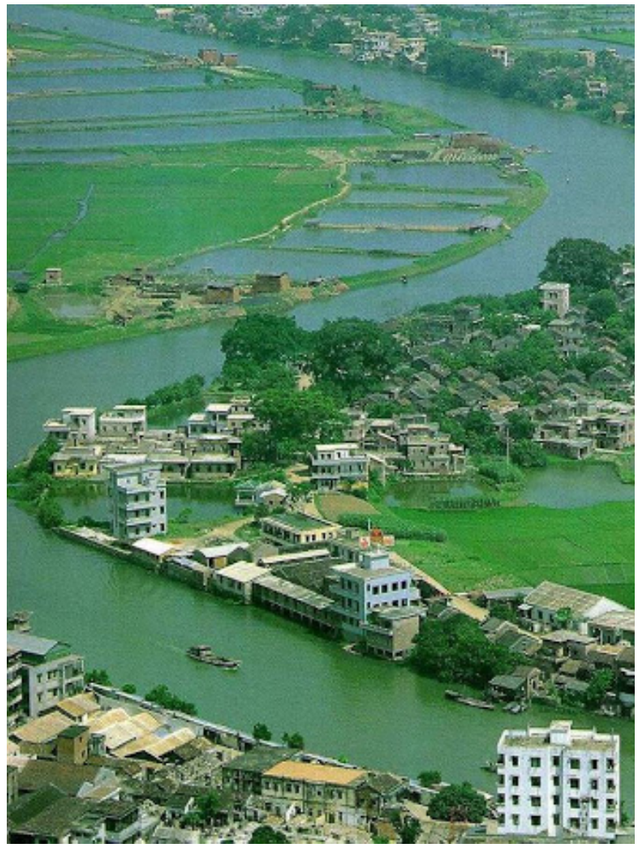
Second mentor: Leo van den Burg

TU Delft

THE PEARL RIVER DELTA...





WITH ONE OF THE FASTEST URBAN DEVELOPMENT SPEED...



Guangzhou



Shenzhen



Hongkong



Macao

RICH IN IDNEITIES RELATED TO WATER AND HISTORICAL HERITAGES



Fishing and markets



Tanka (fishing people)



Traditional villages by the water



Trading history of Guangzhou

11KM

SCALE 1 : 550,000

THE PEARL RIVER DELTA IN 4000B.C.

THE EVOLUTION OF PRD

1950-2015

1900-1950

1600-1900

4000BC-1600

11KM

SCALE 1 : 550,000

GROWING BY SEDIMENTATION & RECLAIMATION

THE EVOLUTION OF PRD

11KM

SCALE 1 : 550,000

ELEVATION

MOUNTAIN

LOW-LYING AREA

11KM

SCALE 1 : 550,000

LOW-LYING AREAS & MOUNTAINS

THE EVOLUTION OF PRD

NETWORK

DIKE

11KM

SCALE 1 : 550,000

INFRUSTRUCTURES

THE EVOLUTION OF PRD

2000-2014
1990-2000
1975-1990
1950-1975
1950

11KM
SCALE 1 : 550,000

URBAN EXPANSION PROCESS

THE FREQUENT URBAN FLOODINGS (RIVER WATER & RAIN WATER)






AND DISSAPEARING IDENTITY...

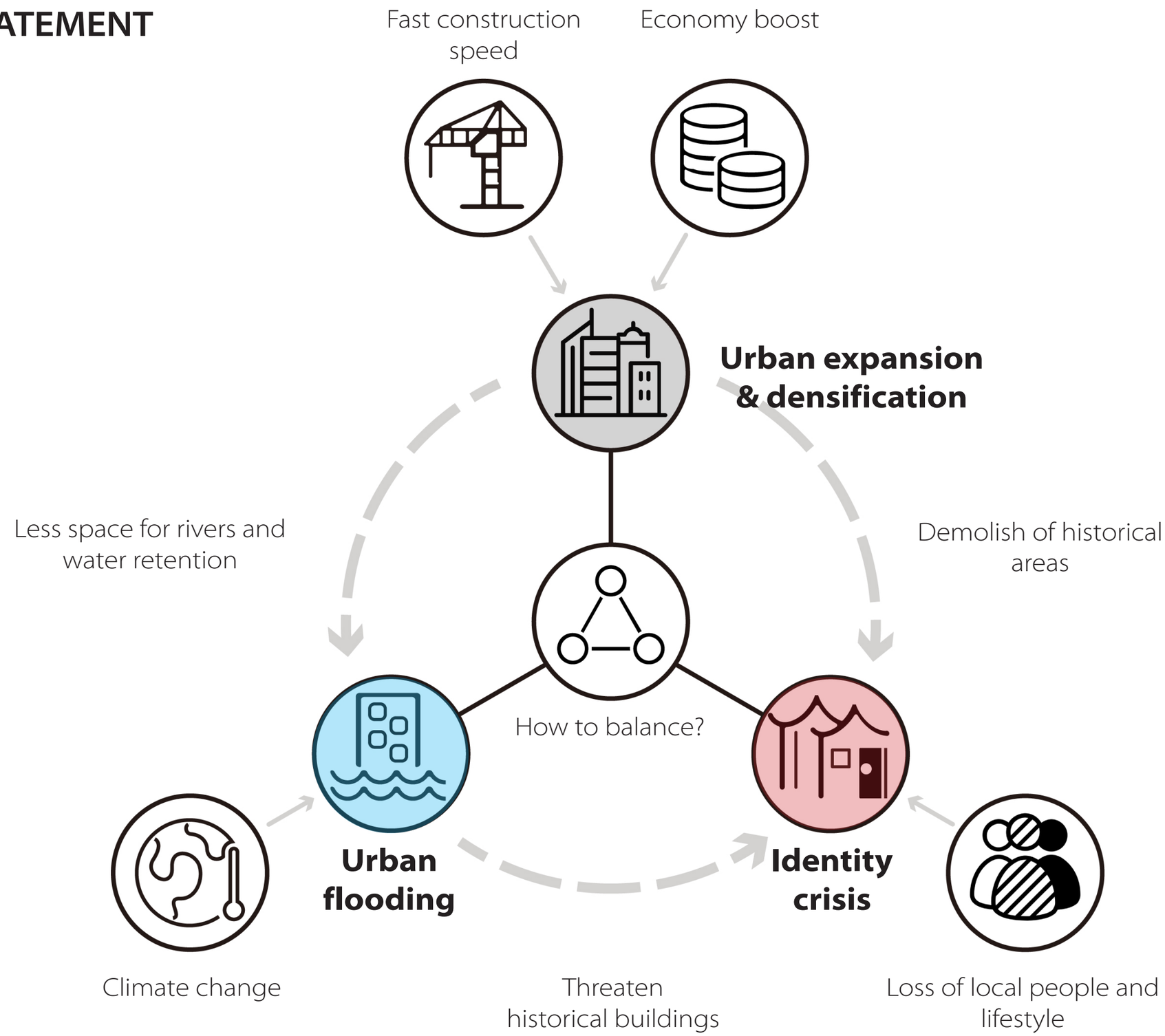








PROBLEM STATEMENT



RESEARCH SITE

GUANGZHOU CITY

HAIZHU DISTRICT

PAZHOU ISLAND

11KM

SCALE 1 : 550,000

REGIONAL HISTORICAL EVOLUTION



1841
QING DYNASTY

5 Stroied Pagoda
Great North Gate
Small Gate
West Gate
OLD CITY
East Gate
NEW CITY
haming Fort
British Factory
Rouge Fort
Arsenal
Battery
Napier Fort
Howqua Fort
Chigang Pagoda
Huangpu Pagoda
HUANGPU ISLAND
Birds Nest Fort
HANAN ISLAND
Huangpu Village
Battery
Anchorage

1.3KM
SCALE 1 : 65,000

Historical village
Fort
Battery
Anchorage
Pagoda
River
Urban center

REGIONAL HISTORICAL EVOLUTION





1949
MODERN CHINA

KUANGCHOU

HAIZHU DISTRICT

PAZHOU

Chigang Pagoda

Pazhou Pagoda

Pazhou Village

Huangpu Village

Xinzhou Village

1.3KM

SCALE 1 : 65,000

Waterway

Regional network

Historical village

Pagoda

River

Urban center

REGIONAL HISTORICAL EVOLUTION



2019
CONTEMPORARY CHINA

TIANHE DISTRICT

YUEXIU DISTRICT

HAIZHU DISTRICT

AN DISTRICT

PAZHOU

Chigang Pagoda

Pazhou Pagoda

Pazhou Village

Huangpu Village

Xinzhou Village

1.3KM

SCALE 1 : 65,000

Waterway

Regional network

Historical village

Pagoda

River

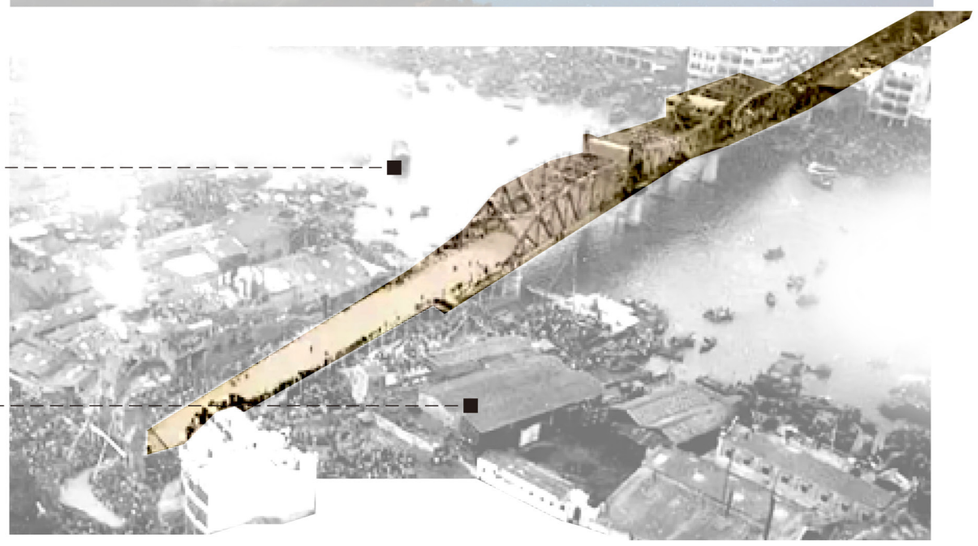
Urban center

HISTORICAL CONCLUSION

MODERN CITY



SHIPPING & TRADING

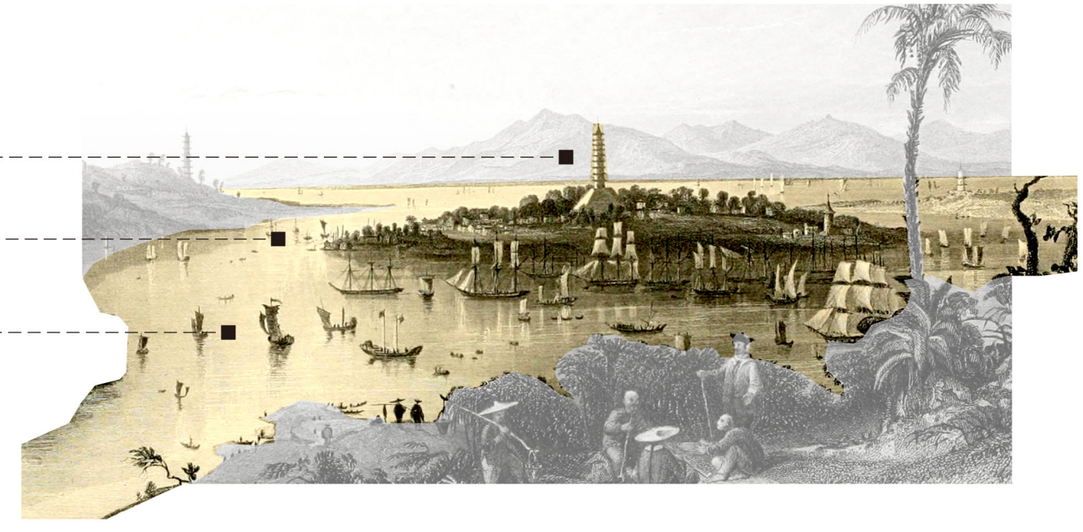


INDUSTRY

PAGODA

FISHING

SHIPPING & TRADING



URBAN DEVELOPMENT

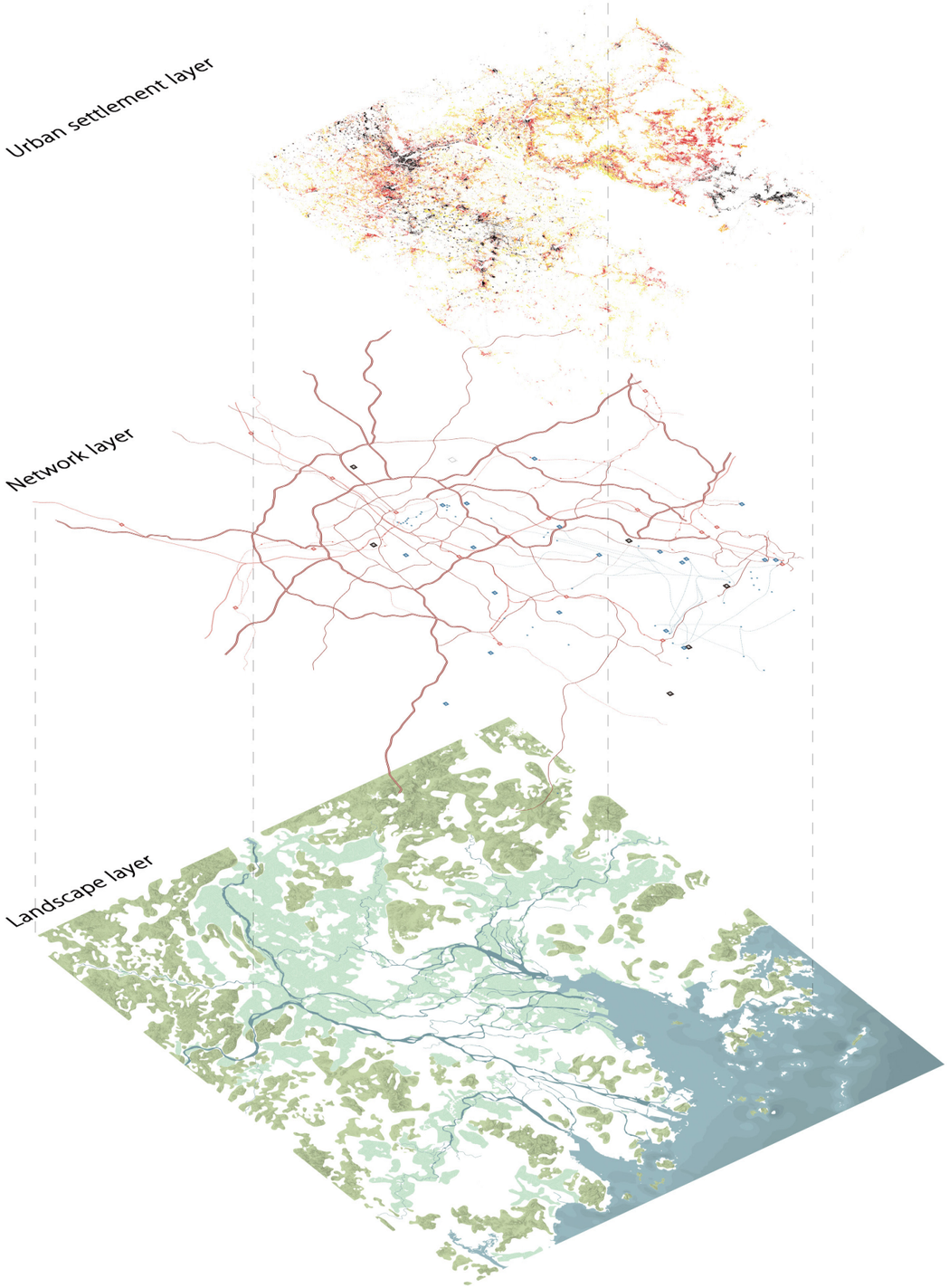
PROVIDE CONDITION

TRANSPORTATION NETWORK

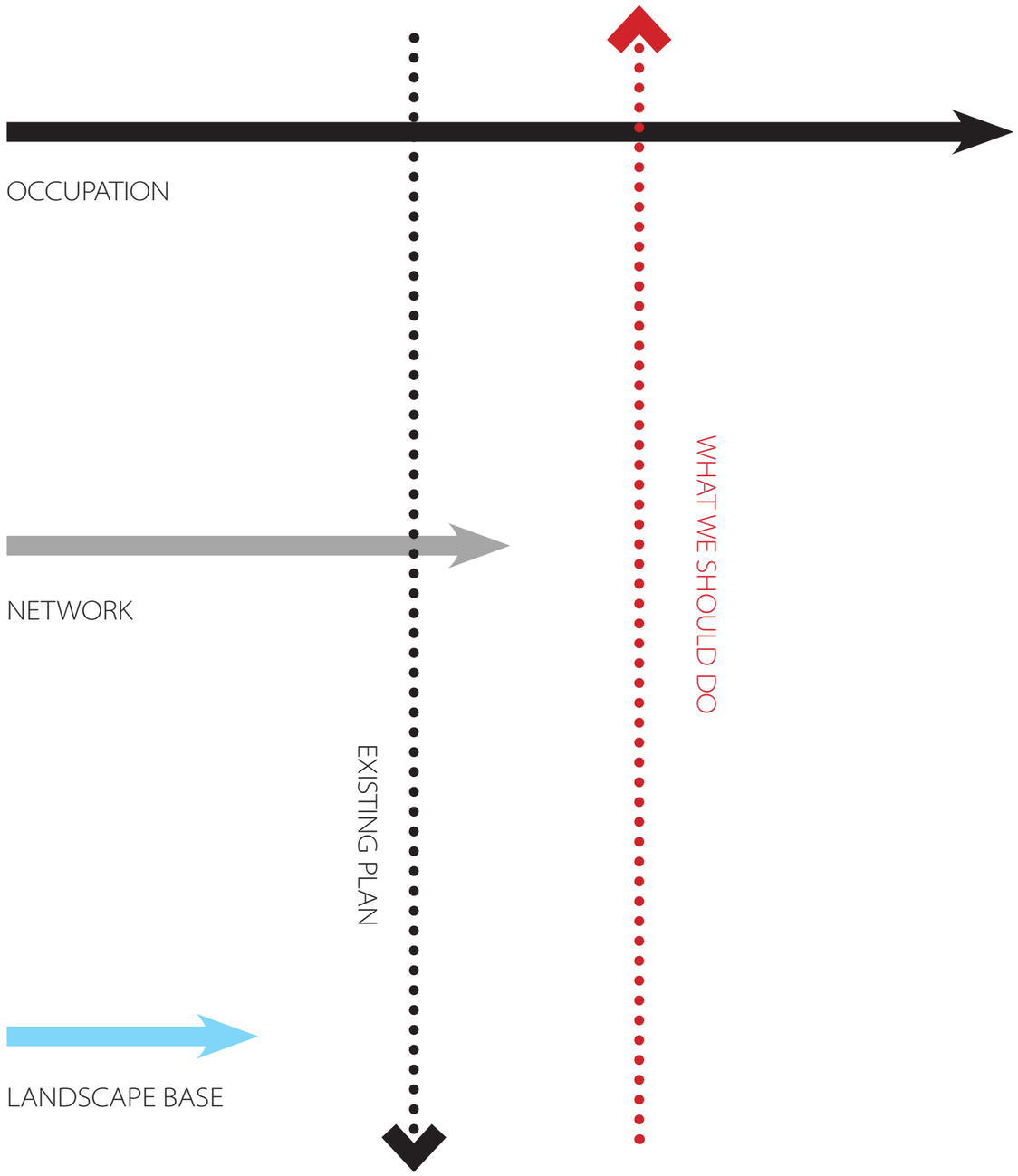
PROVIDE CONDITION

PEARL RIVER

THE LAYERED APPROACH



CHANGING SPEED



EXISTING RIVER SITUATION

FLOOD WALLS AND HARD EDGES



FLOOD WALLS



CANAL EDGES

PAZHOU ISLAND

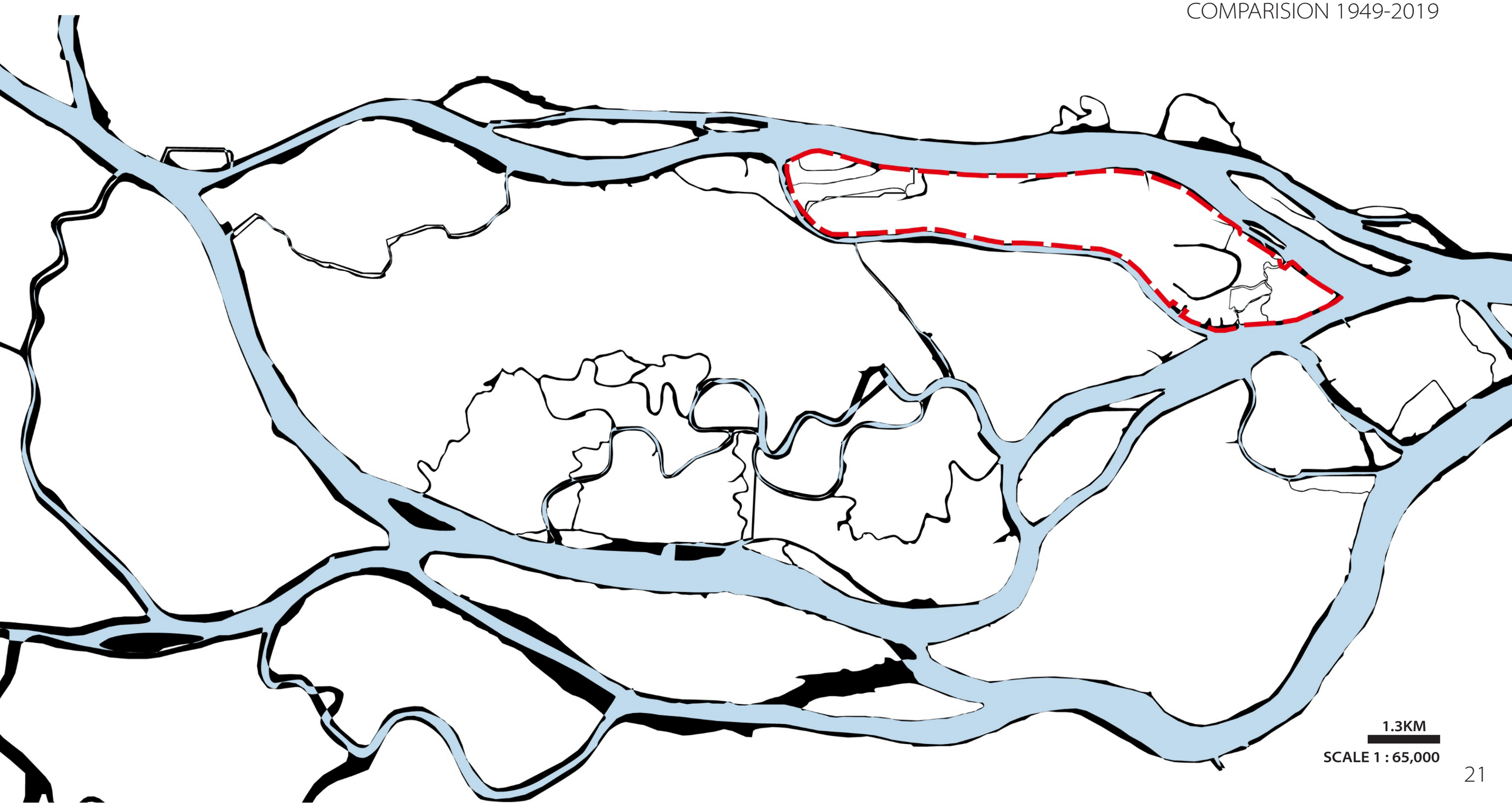
1.3KM

SCALE 1 : 65,000

EXISTING RIVER SITUATION

NARROWING OF THE RIVERS

COMPARISION 1949-2019



EXISTING RIVER SITUATION

THE TWO FLOODING PROBLEMS



Inner dike rainwater flooding
in Pazhou on 2015-08-14
(source: sohu)



Outer dike river water flooding
in Pazhou on 2018-09-16 Super typhoon "Mangkhut"
(source: kknews)

EXISTING REGIONAL URBAN DEVELOPMENT

URBAN EXPANSION TOWARDS EAST

CENTER CHANGE

OLD URBAN CENTER

NEW URBAN CENTER

ECONOMICAL ZONE

PAZHOU ISLAND

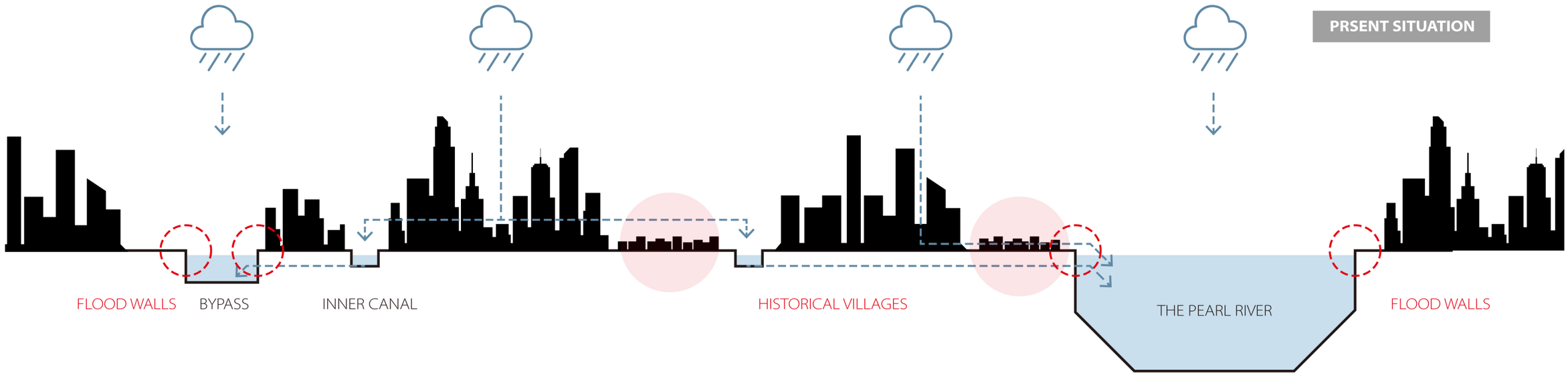
URBAN EXPANSION

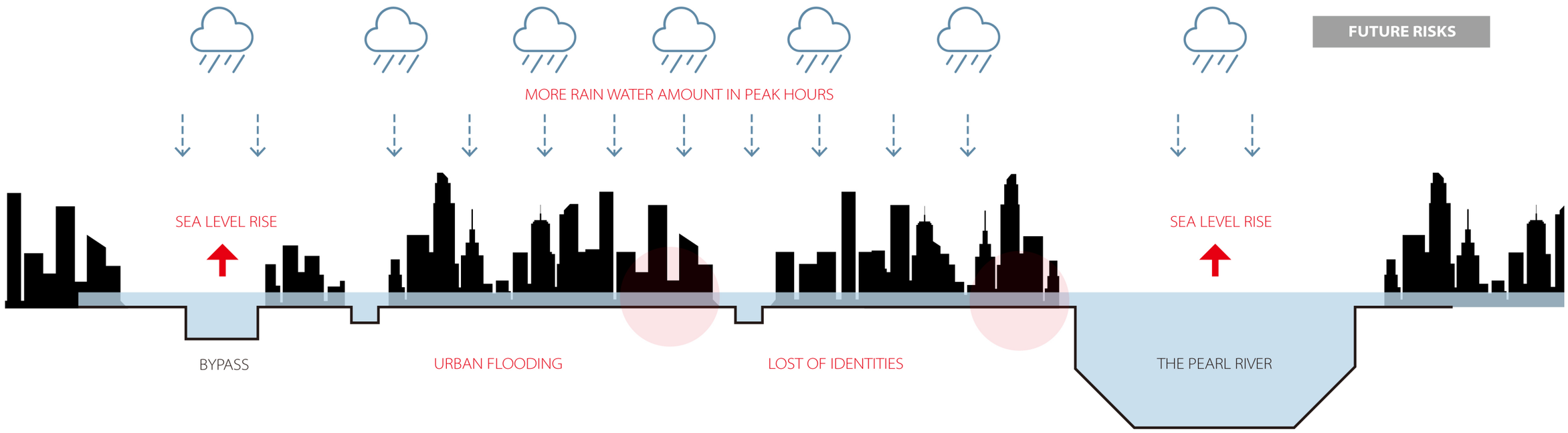
ECOLOGICAL PARK

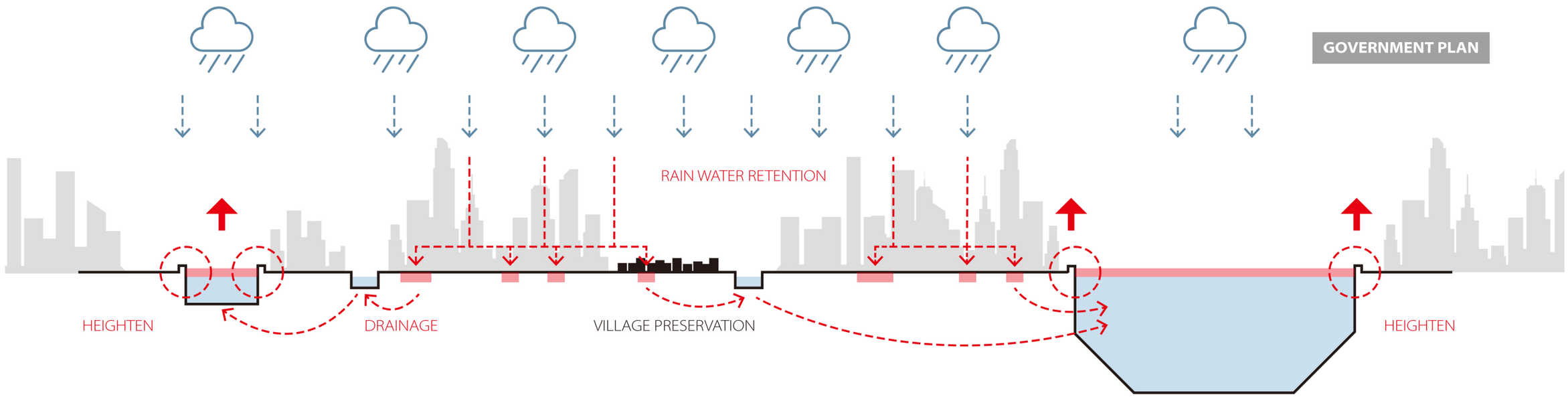
1.3KM

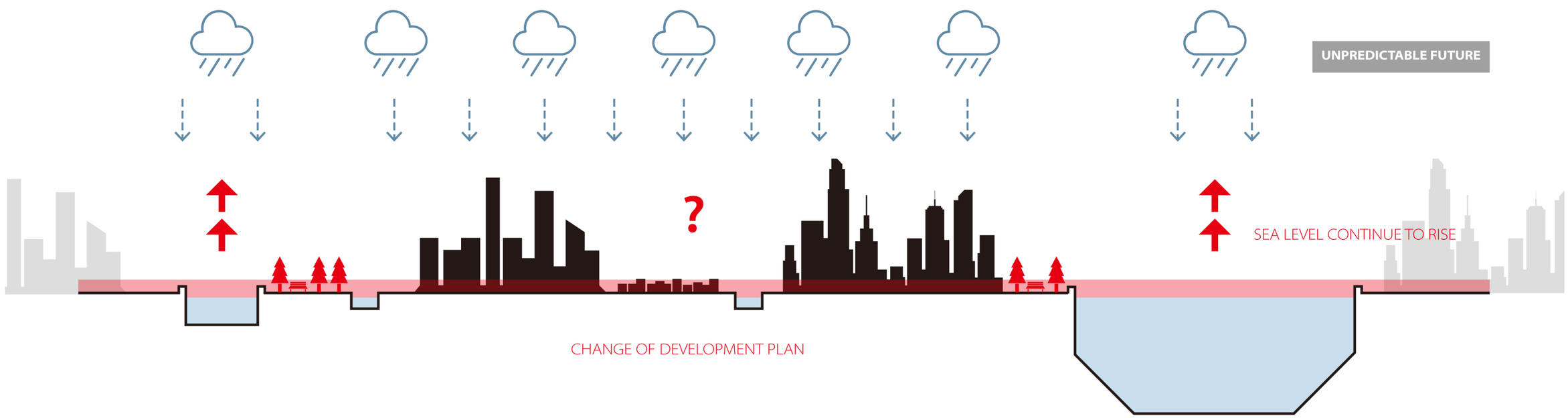
SCALE 1 : 65,000

THE EXISTING PLANNING PRACTICE






GOVERNMENT PLAN
RAIN WATER RETENTION
HEIGHTEN
DRAINAGE
VILLAGE PRESERVATION
HEIGHTEN


UNPREDICTABLE FUTURE
?
SEA LEVEL CONTINUE TO RISE
CHANGE OF DEVELOPMENT PLAN

OBJECTIVE

To design a landscape framework and explore adaptive design principles for water resilient urban development of Pazhou

ISLAND AREA
10.4km^2 (1,040ha)

0.5KM

SCALE 1 : 25,000

RESEARCH & DESIGN SCALES

LOCAL SCALE
DESIGN

PAZHOU SCALE PLANNING

REGIONAL SCALE PLANNING

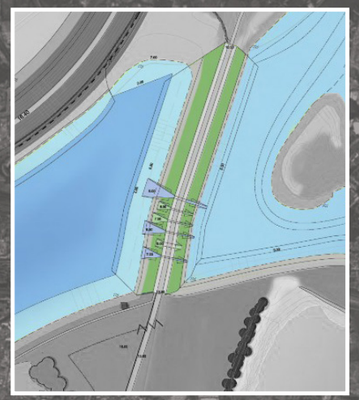
REGIONAL SCALE PLANNING

RESILIENT LANDSCAPE STRUCTURE

New higher dikes dealing with sea level rise
Dike move inwards to provide more space for the rivers

More combined dike system, less financial pressure
Controlled Inner canals for rainwater drainage system





1.3KM

SCALE 1 : 65,000

REGIONAL SCALE PLANNING

RESILIENT LANDSCAPE STRUCTURE

To reconnect the water front green corridor in Pazhou island

PAZHOU
ISLAND

REGIONAL
WATERFRONT
GREEN CORRIDOR



STOPPED HERE
(MID-EAST PAZHOU)



1.3KM

SCALE 1 : 65,000

REGIONAL SCALE PLANNING

RESILIENT LANDSCAPE STRUCTURE

To connect the ecological axis
Make use of the green areas in Pazhou island



MOUNTAIN ECOLOGICAL ZONE

PAZHOU ISLAND



FARMLAND IN PAZHOU



HAIZHU ECOLOGICAL PARK

RIVER OUTLET ECOLOGICAL ZONE

1.3KM

SCALE 1 : 65,000

REGIONAL SCALE PLANNING

IMPROVEMENTS OF NETWORK STRUCTURE

Extend the networks from Pazhou east
Change of highway route to protect the historical village



THE BUILDING HIGHWAY

CHANGE OF ROUTE

EXPAND TOWARDS EAST AND SOUTH

1.3KM

SCALE 1 : 65,000

PAZHOU ISLAND...



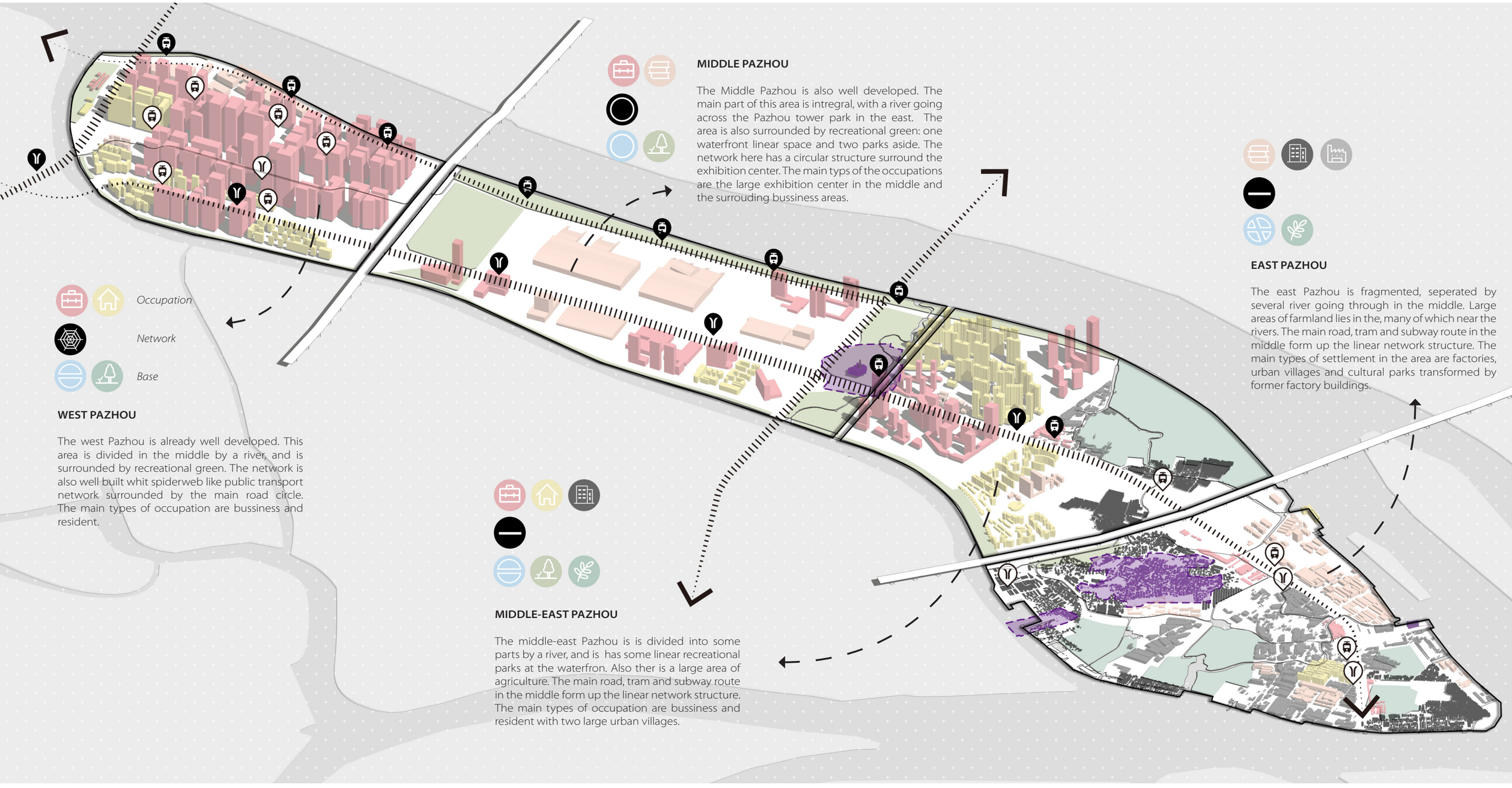
THE WEST



THE EAST

PAZHOU SCALE PLANNING & DESIGN

SPATIAL SUMMARY



WEST PAZHOU

The west Pazhou is already well developed. This area is divided in the middle by a river, and is surrounded by recreational green. The network is also well built whit spiderweb like public transport network surrounded by the main road circle. The main types of occupation are bussiness and resident.

MIDDLE PAZHOU

The Middle Pazhou is also well developed. The main part of this area is intregral, with a river going across the Pazhou tower park in the east. The area is also surrounded by recreational green: one waterfront linear space and two parks aside. The network here has a circular structure surround the exhibition center. The main typs of the occupations are the large exhibition center in the middle and the surrouding bussiness areas.

MIDDLE-EAST PAZHOU

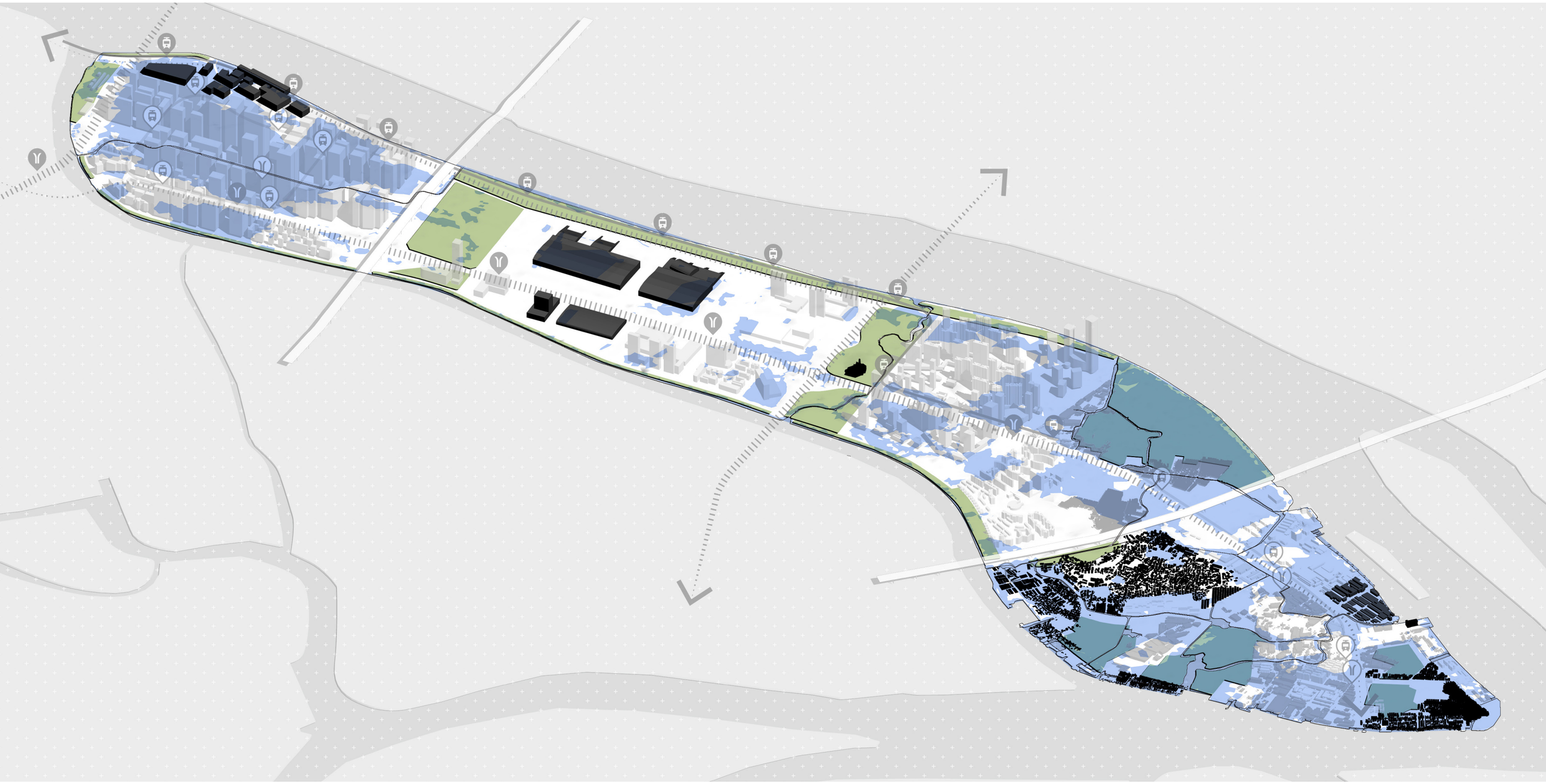
The middle-east Pazhou is is divided into some parts by a river, and is has some linear recreational parks at the waterfron. Also ther is a large area of agriculture. The main road, tram and subway route in the middle form up the linear network structure. The main types of occupation are bussiness and resident with two large urban villages.

EAST PAZHOU

The east Pazhou is fragmented, seperated by several river going through in the middle. Large areas of farmland lies in the, many of which near the rivers. The main road, tram and subway route in the middle form up the linear network structure. The main types of settlement in the area are factories, urban villages and cultural parks transformed by former factory buildings.

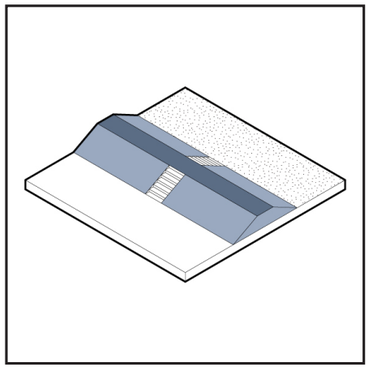
PAZHOU SCALE PLANNING & DESIGN

CHALLENGES SUMMARY

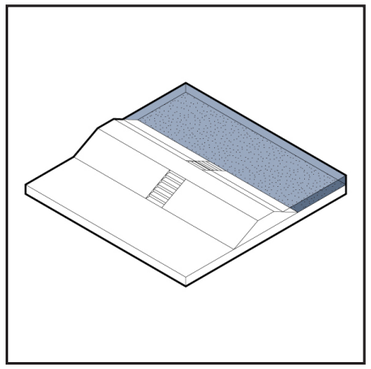


PRINCIPLES

RIVER WATER FLOODING

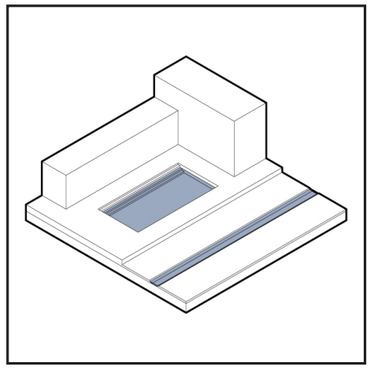


BUILD NEW DIKES
INLAND-WARDS



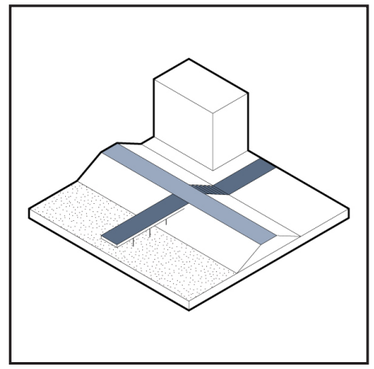
CREATE FLOOD PLAINS

RAIN WATER FLOODING



RAINWATER RETENTION &
DRAINAGE SYSTEM

FRAGMENTED GREEN

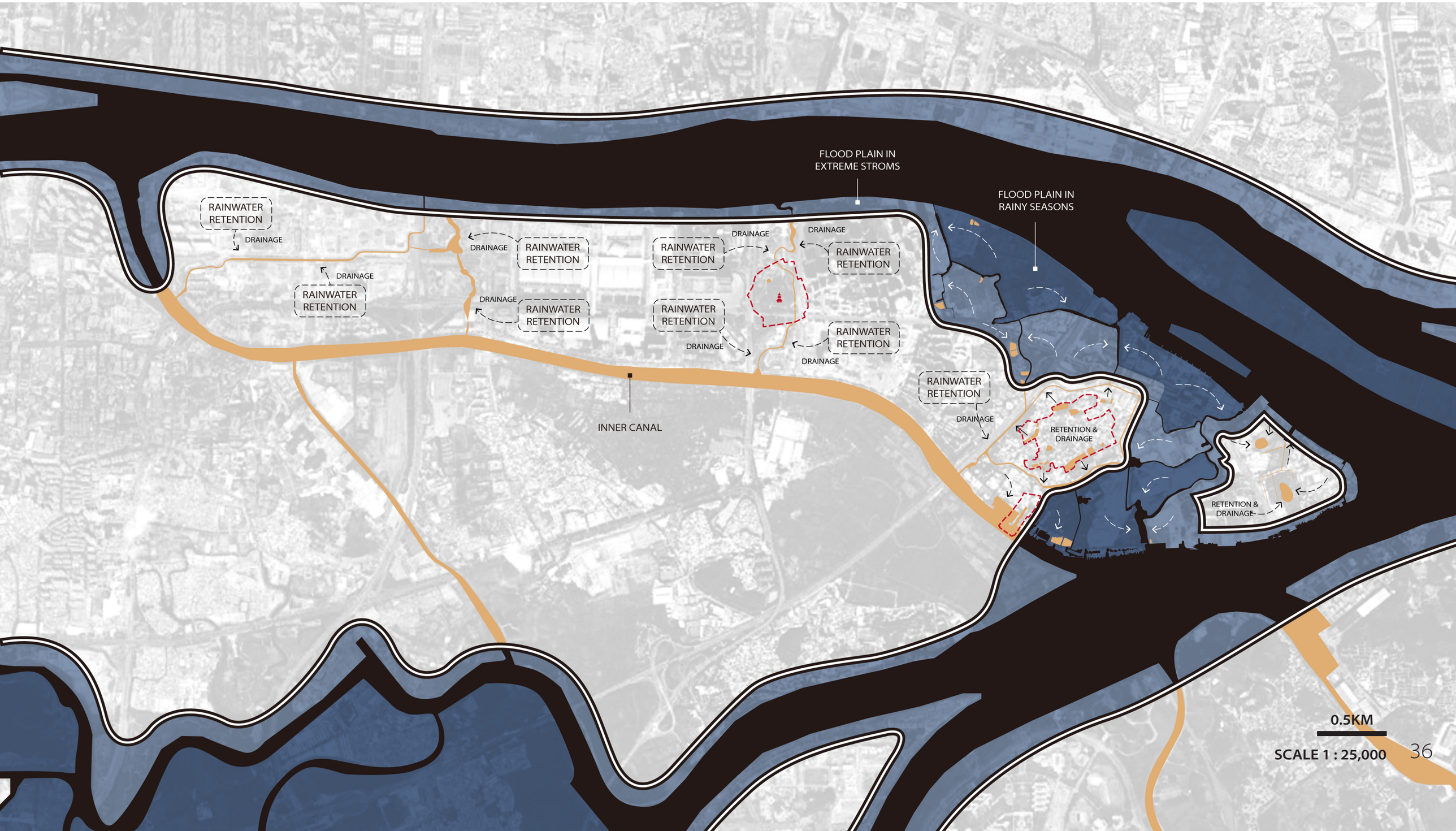


GREEN CONNCETION

PAZHOU SCALE PLANNING & DESIGN

RESILIENT LANDSCAPE STRUCTURE

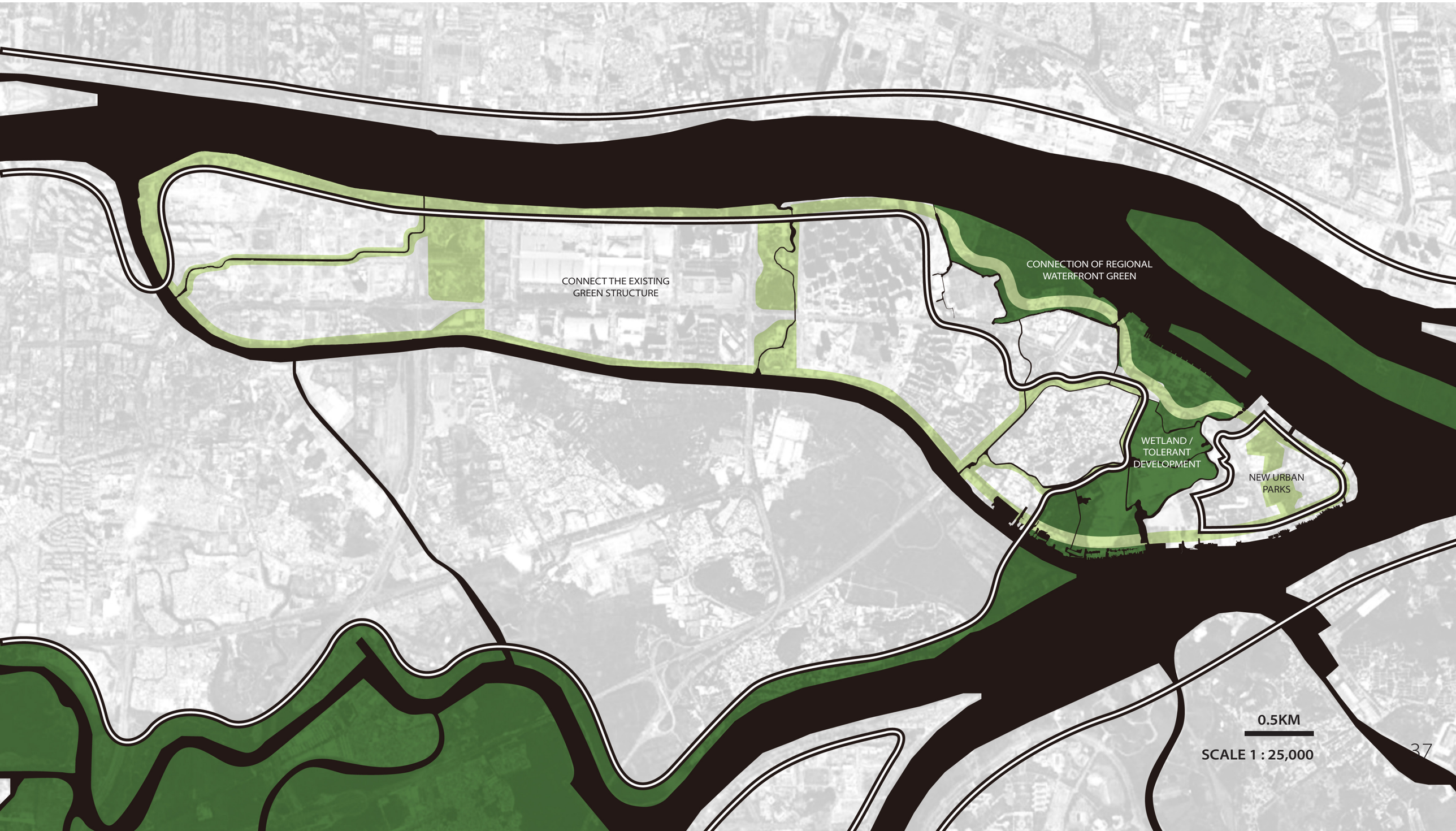
THE BLUE STRUCTURE



PAZHOU SCALE PLANNING & DESIGN

RESILIENT LANDSCAPE STRUCTURE

THE GREEN STRUCTURE



PAZHOU SCALE PLANNING & DESIGN

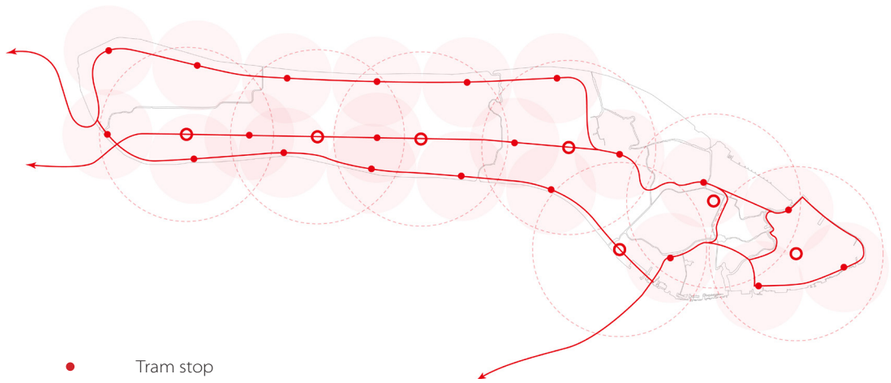
NEW TOD NETWORK STRUCTURE

APPLICATION OF TOD PRINCIPLES

DEVELOPING HIGH-QUALITY PUBLIC TRANSPORT

1km service range regional public transport centers

400m service range local public transport stops

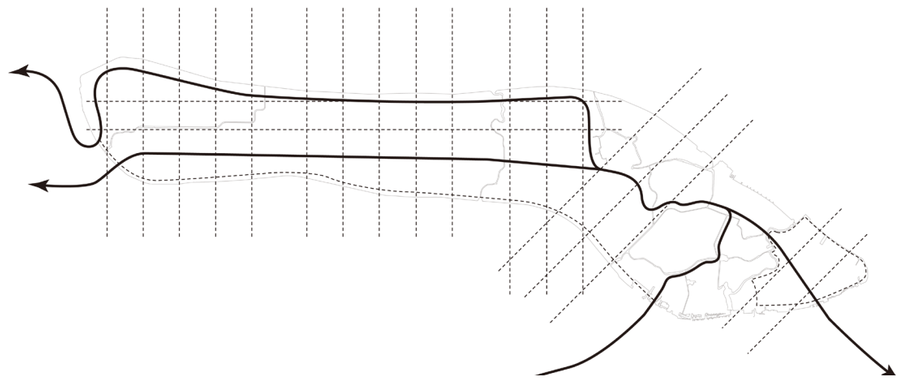


INCREASE ROAD NETWORK DENSITY

300m Module

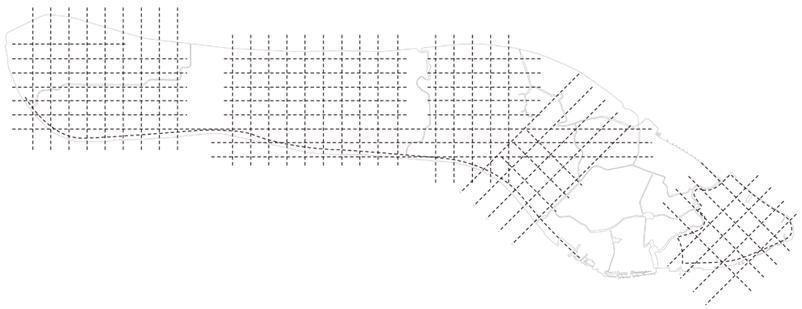
≤45m road width

≥50 crossroads / km2



DESIGNING WALKABLE STREETS AND NEIGHBORHOODS

150m walkable neighborhood size

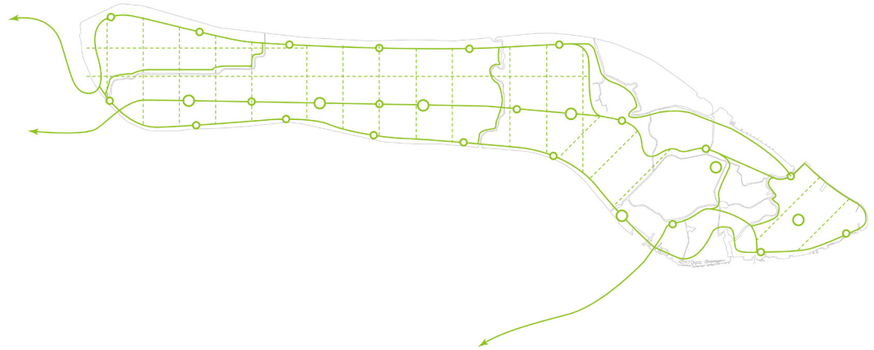


PRIORITY ON BICYCLE NETWORK

≥3m road width

bicycles stops beside public transport stations

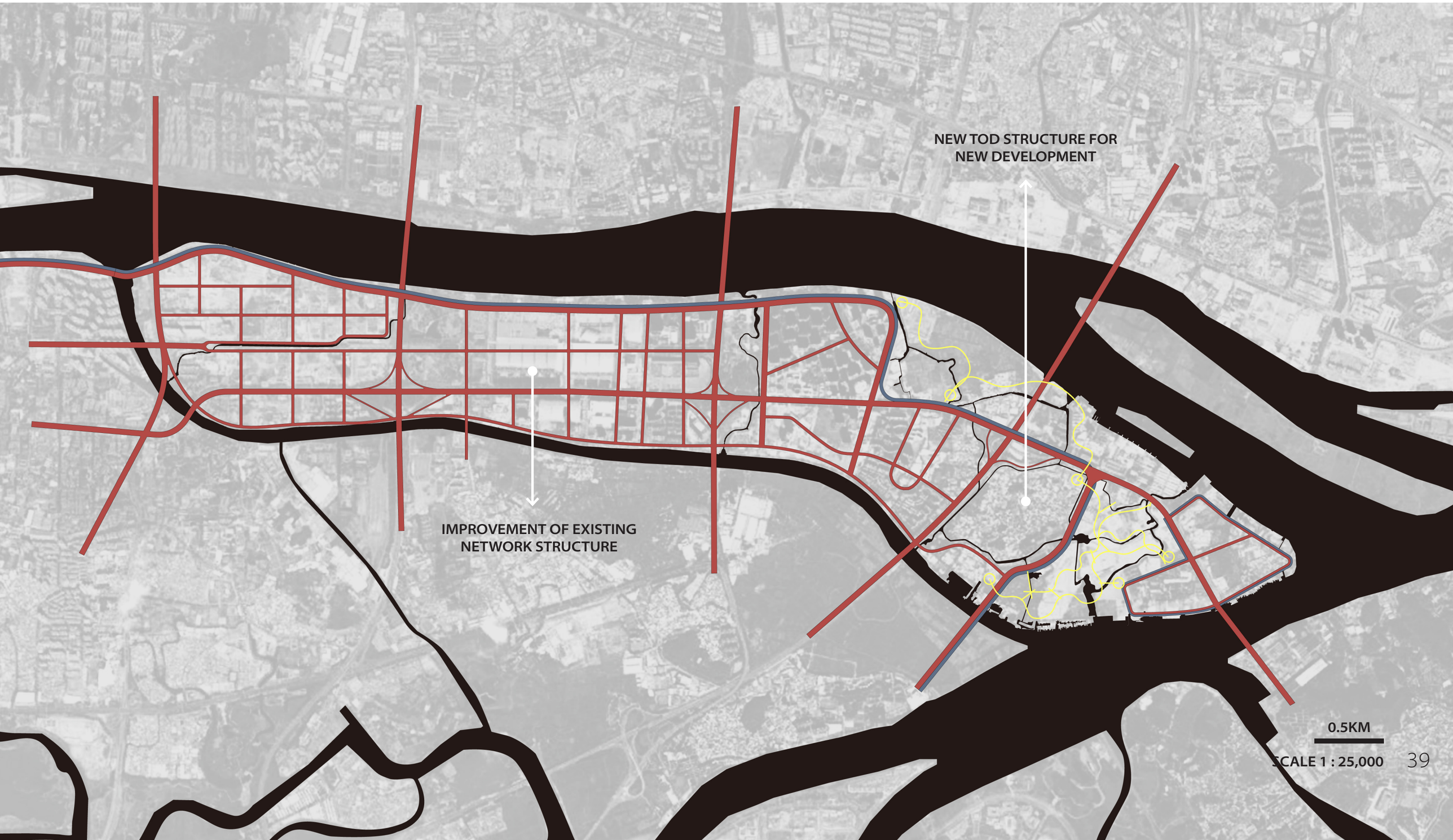
Along the green & blue structure



PAZHOU SCALE PLANNING & DESIGN

NEW TOD NETWORK STRUCTURE

THE NEW TRAFFIC STRUCTURE

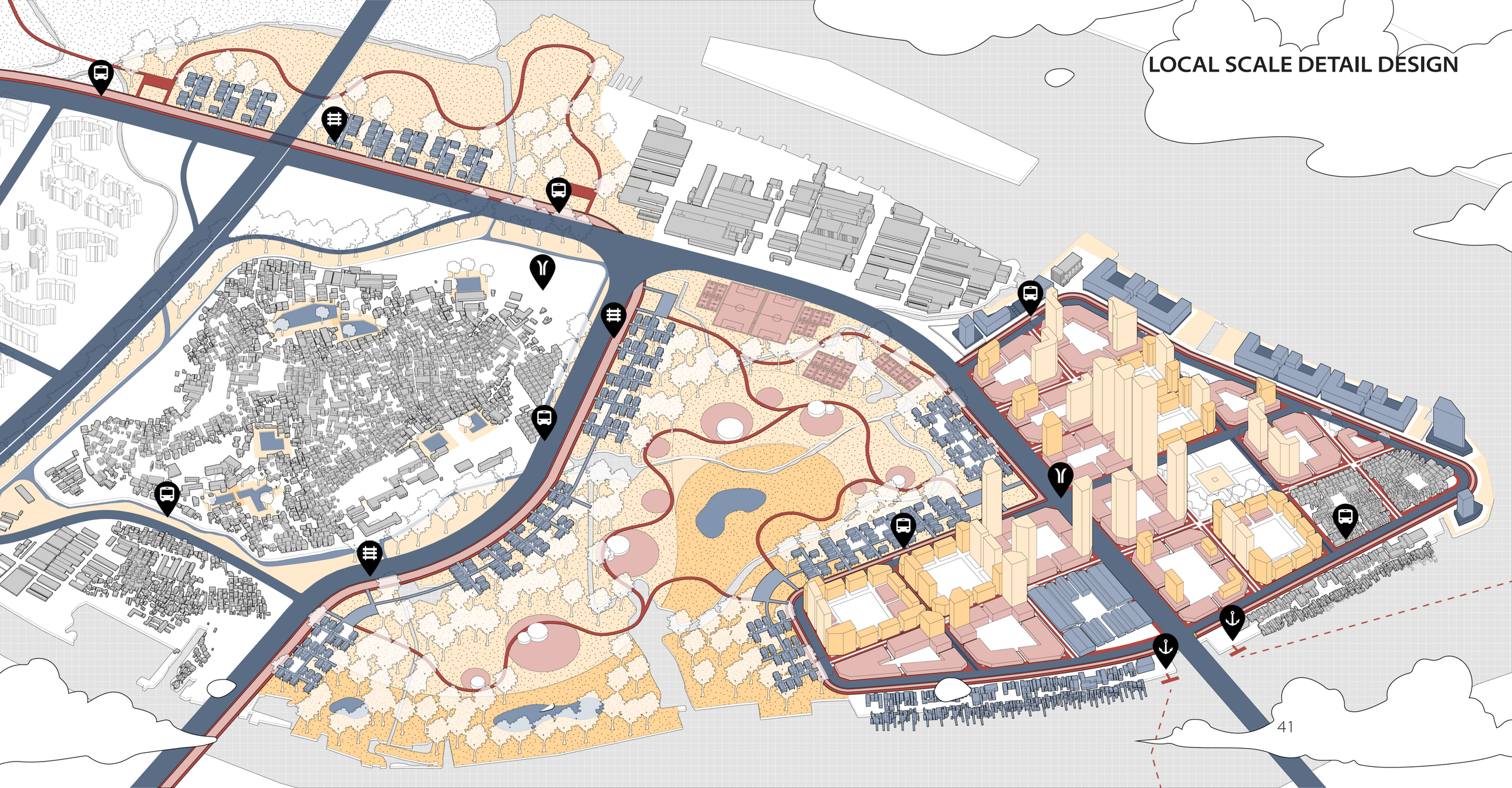


RESEARCH & DESIGN SCALES



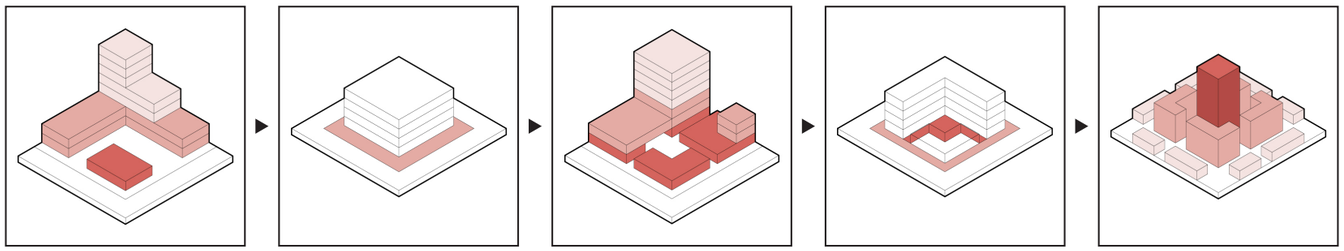
LOCAL SCALE
DETAIL DESIGN

LOCAL SCALE DETAIL DESIGN



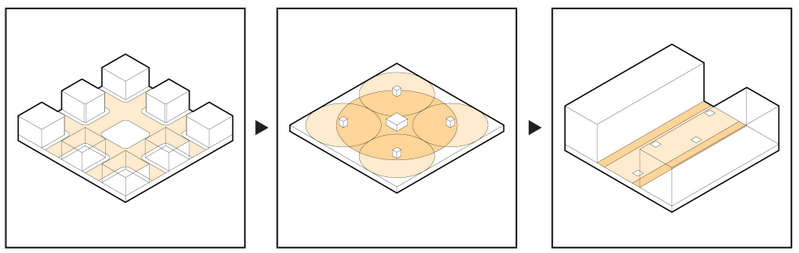
DESIGN PRINCIPLES

PRINCIPLES FOR URBAN SPATIAL QUALITY



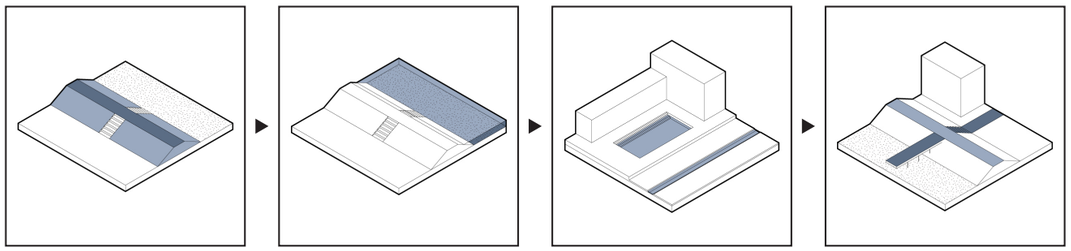
MULTIPLE FUNCTIONAL NEIGHBORHOODS | SPATIAL CONCESSION | MIX TYPE OF BUILDINGS | SEMI-PUBLIC SPACE | HEIGHT & VIEW CONTROL

PRINCIPLES FOR TOD NETWORK



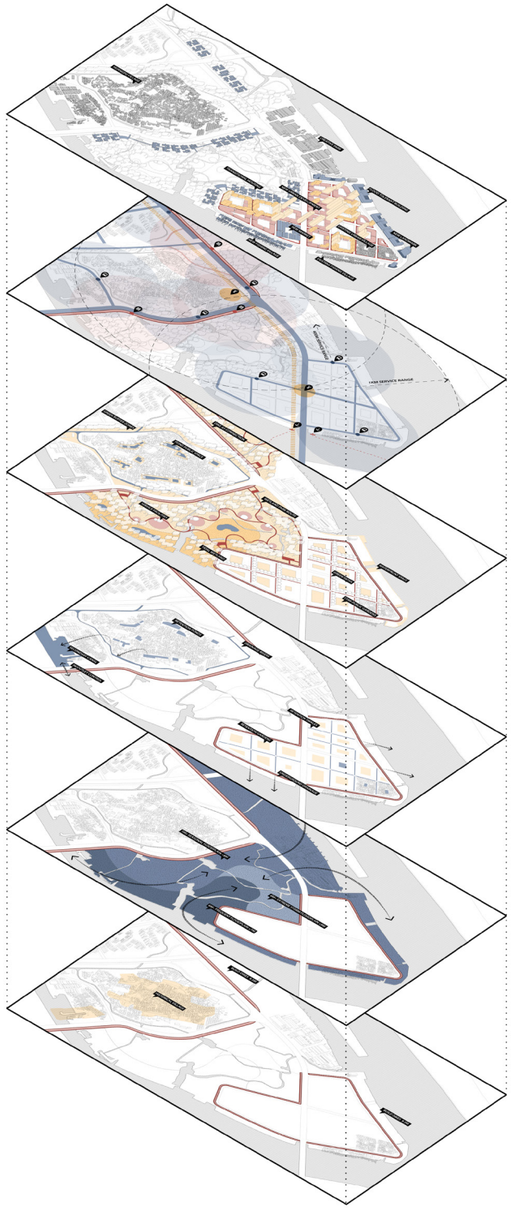
INCREASE FAST TRAFFIC NETWORK DENSITY | MULTIPLE PUBLIC TRANSPORT NETWORKS | SLOW TRAFFIC & WALKABLE NEIGHBORHOODS

PRINCIPLES FOR WATER RESILIENT LANDSCAPE STRUCTURE



BUILD NEW DIKES INLAND-WARDS | CREATE FLOOD PLAINS | RAINWATER RETENTION & DRAINAGE SYSTEM | GREEN CONNCETION

DESIGN BY LAYERS



URBAN SETTLEMENTS

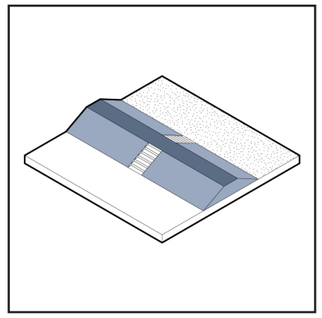
TOD STRUCTURE

GREEN STRUCTURE

RETENTION

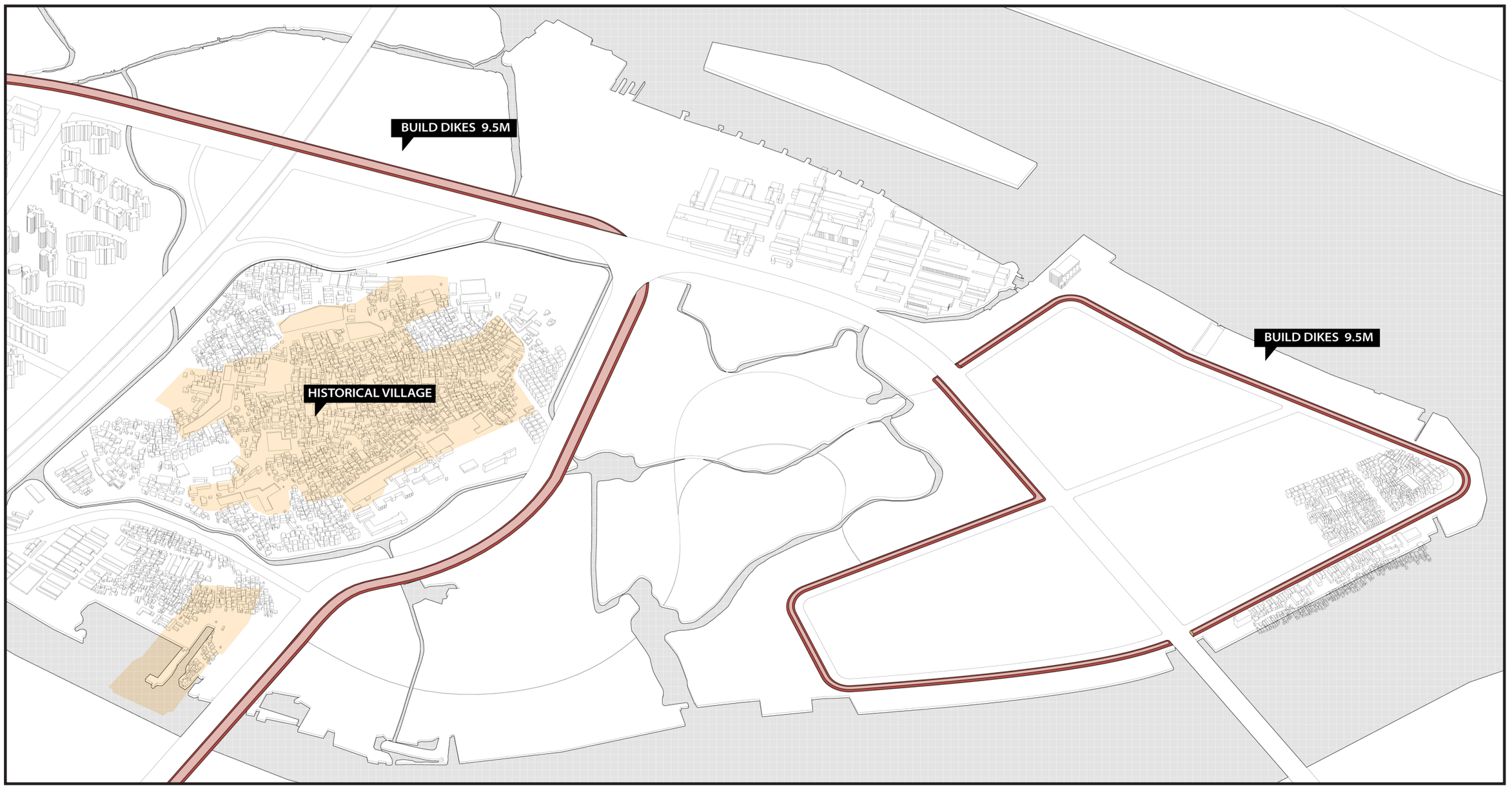
FLOOD PLAIN

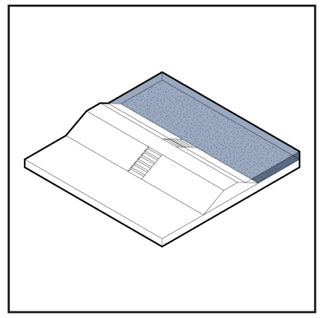
DIKE STRUCTURE



LANDSCAPE LAYER

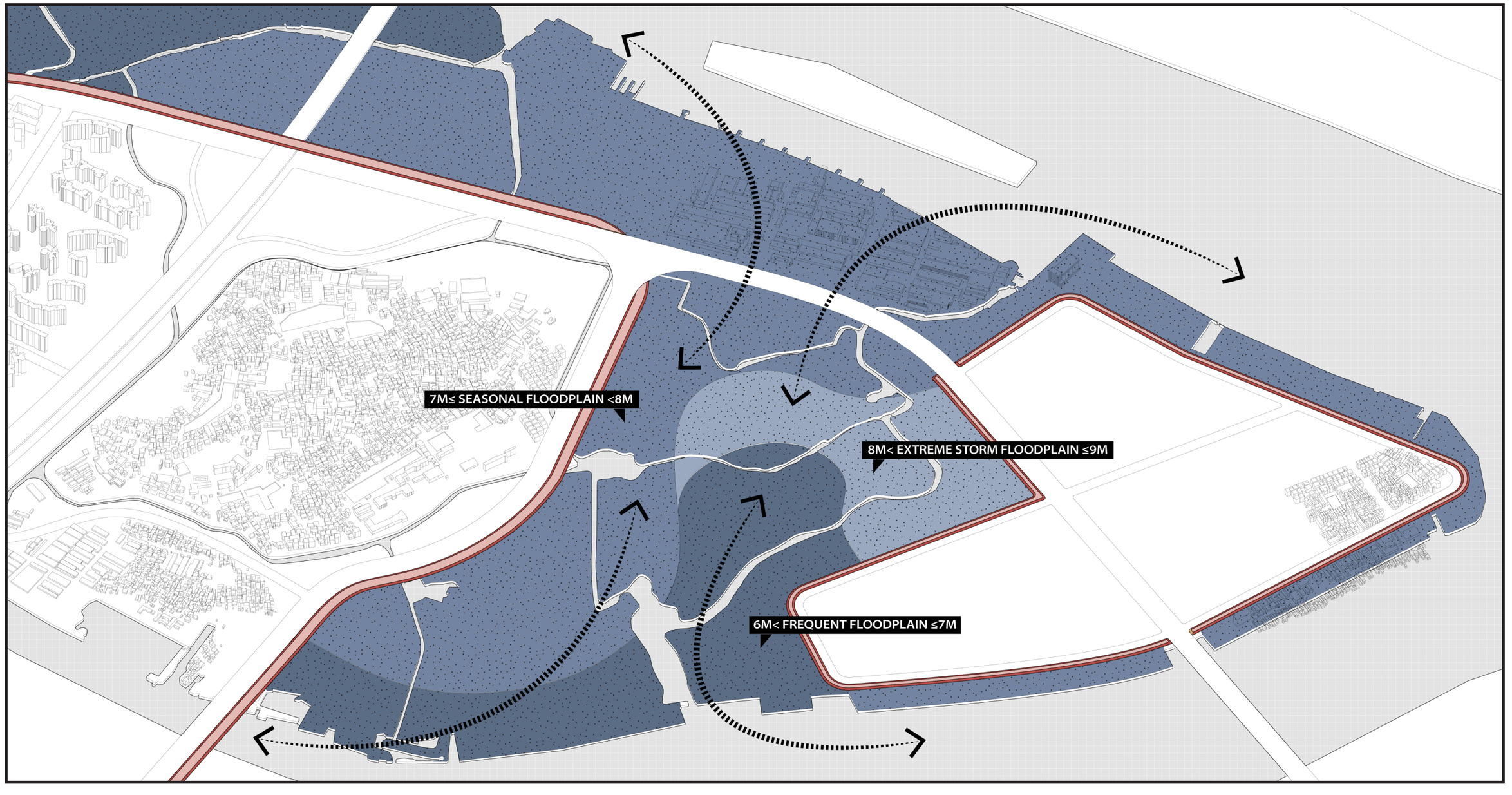
BUILD NEW DIKES INLAND-WARDS

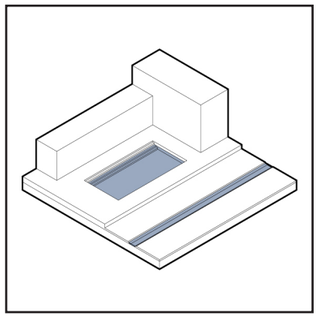




LANDSCAPE LAYER

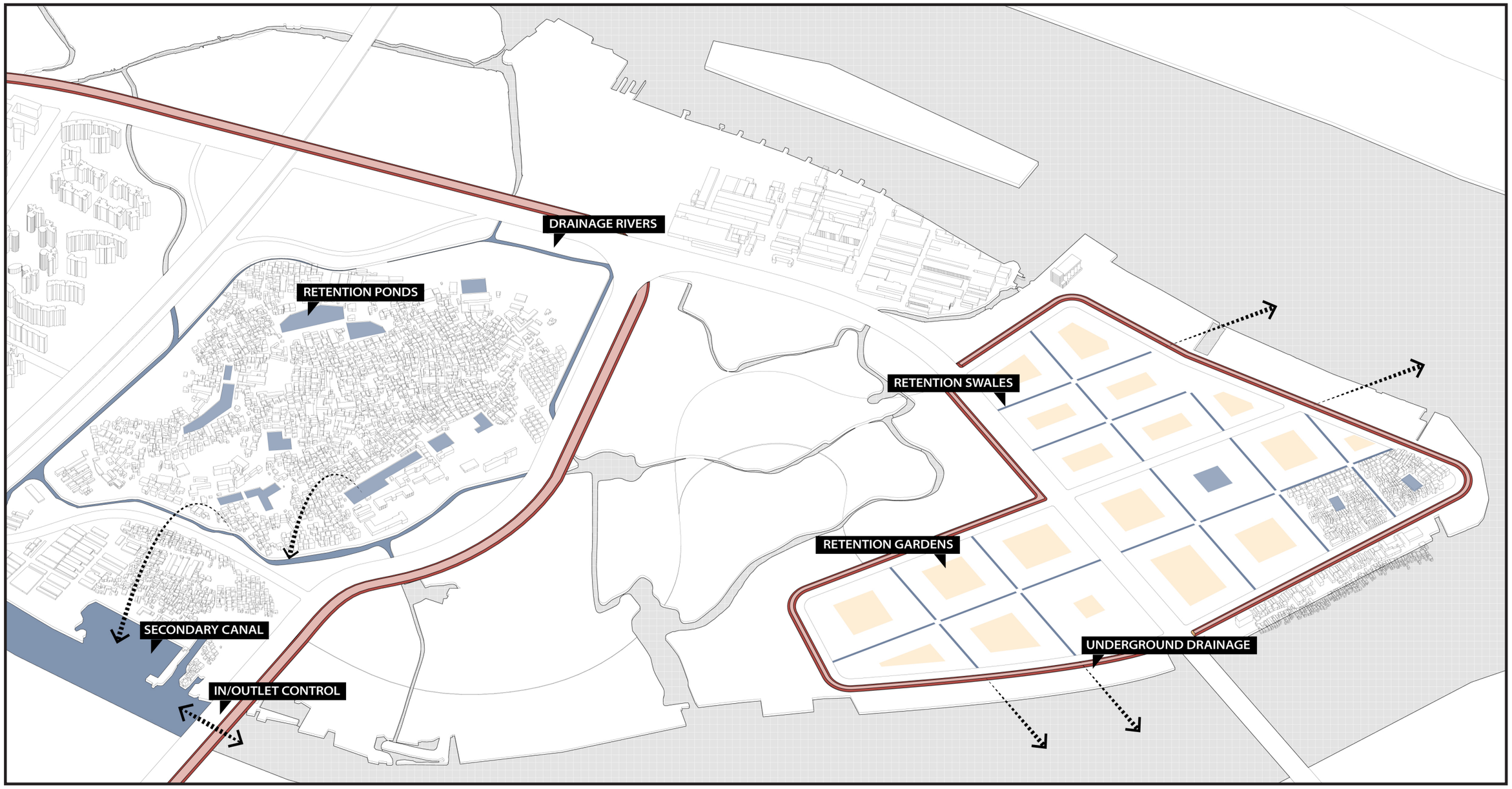
CREATE FLOOD PLAINS





LANDSCAPE LAYER

RAINWATER RETENTION & DRAINAGE SYSTEM

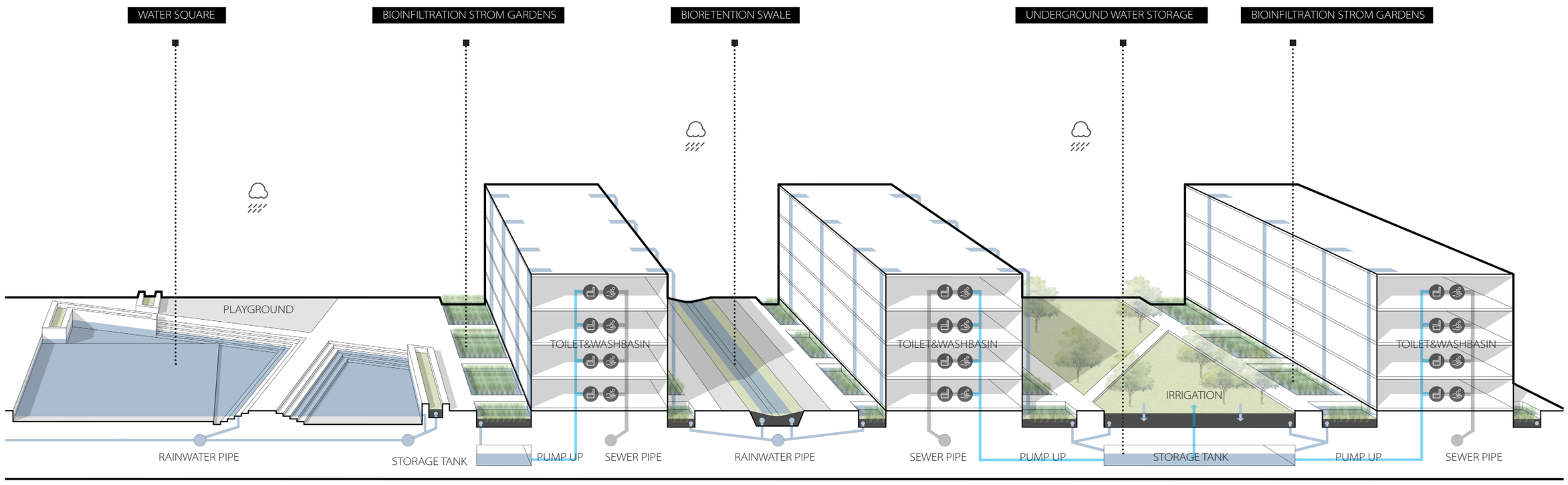


RAINWATER RETENTION & DRAINAGE SYSTEM

RAINWATER RETENTION/FILTRATION/STORAGE SYSTEM

WATER REUSE SYSTEM

BLACK WATER SYSTEM

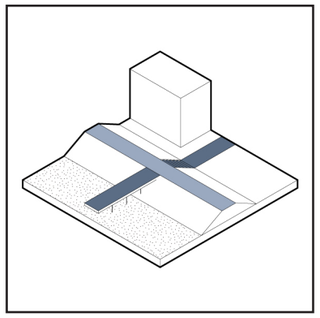


PLAYGROUND / WATER SQUARE

RESIDENTIAL AREA

ROAD / GREEN PATH

RESIDENTIAL AREA / NEIGHBOURHOOD PARK



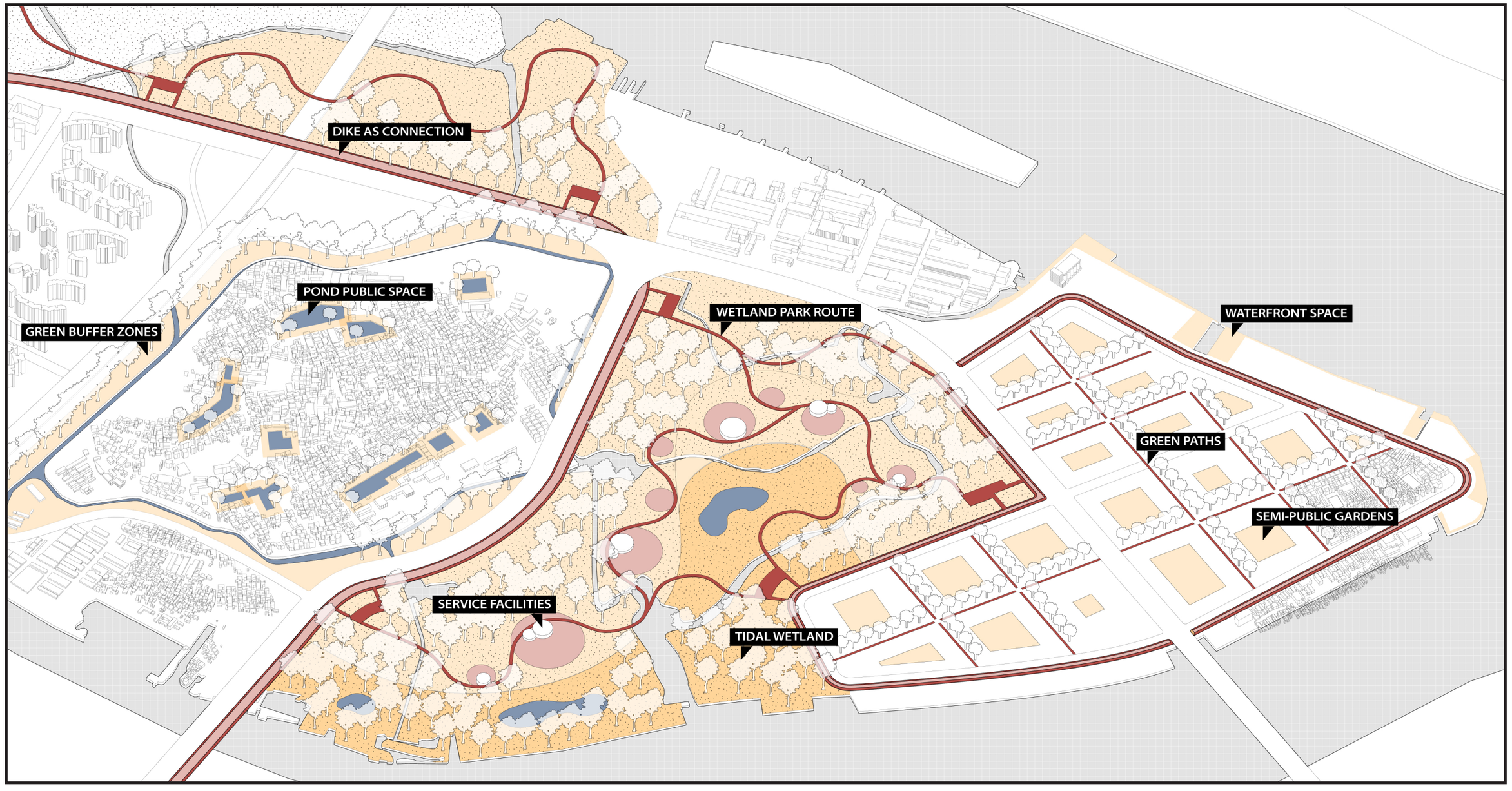
LANDSCAPE LAYER

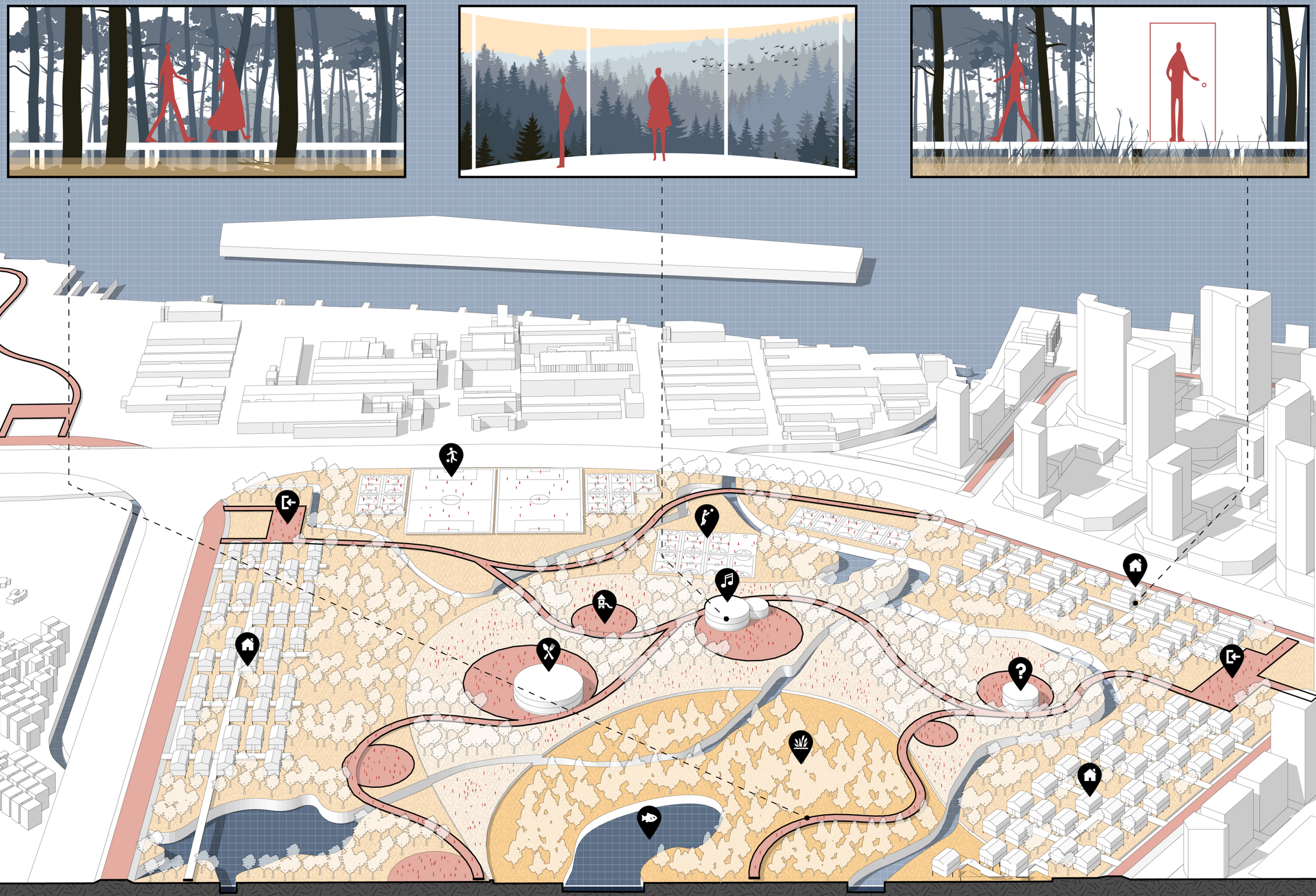
GREEN CONNECTION





Tidal wetland parkReference: Yanweizhou Park, Jinhua, China





WETLAND PARK FUNCTIONS

WETLAND HABITATS & SPECIES

JANUARY — DECEMBER

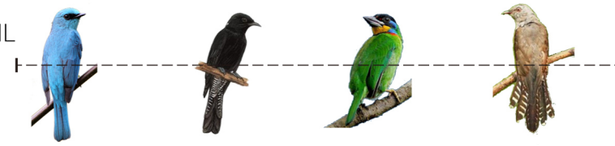
RESIDENT BIRD



Copsychus saularis · *Spilopelia chinensis* · *Acridotheres cristatellus* · *Sturnus sericeus* · *Zosterops japonicus* · *Pycnonotus jocosus* · *Pycnonotus sinensis* · *Garrulax perspicillatus* · *Hirundo rustica*

SUMMER MIGRATORY BIRD

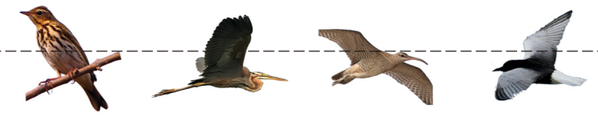
APRIL — JUNE



Eumyias thalassinus · *Surniculus lugubris* · *Megalaima oorti* · *Cacomantis merulinus*

AUTUMN / WINTER MIGRATORY BIRD

AUGUST — DECEMBER



Anthus richardi · *Ardea purpurea* · *Numenius phaeopus* · *Chlidonias leucopterus*

MAIN FLORA COMMUNITY



Taxodium distichum



Scirpus tabernaemontan · *Phragmites arka*



Phragmites hragmites communis · *Eragrostis cilianensis* · *Imperata cylindrica*



Glyptostrobus pensilis



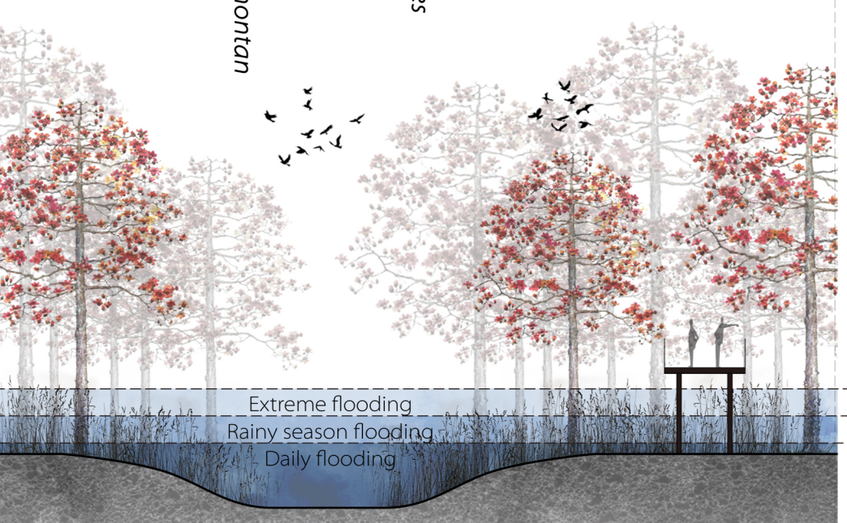
Mikania micrantha · *Pennisetum purpureum*



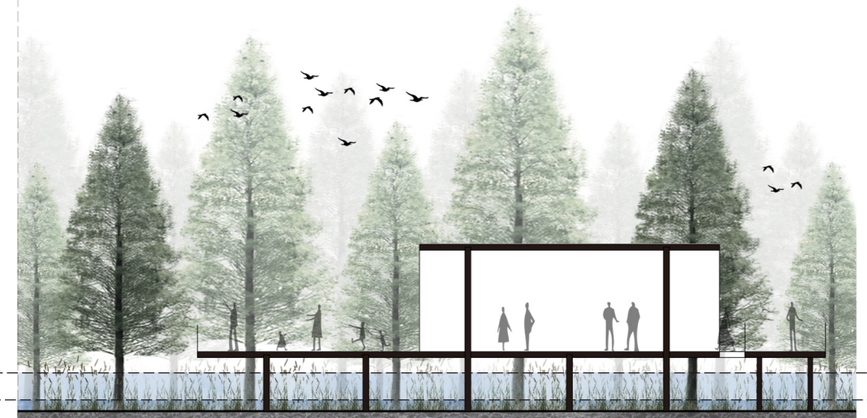
Eucalypius urophylla



Ficus microcarpa



6M < NATURAL WETLAND ≤ 7M



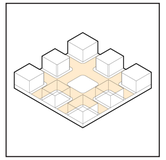
7M ≤ WETLAND PARK < 8M



8M < WETLAND PARK ≤ 9M

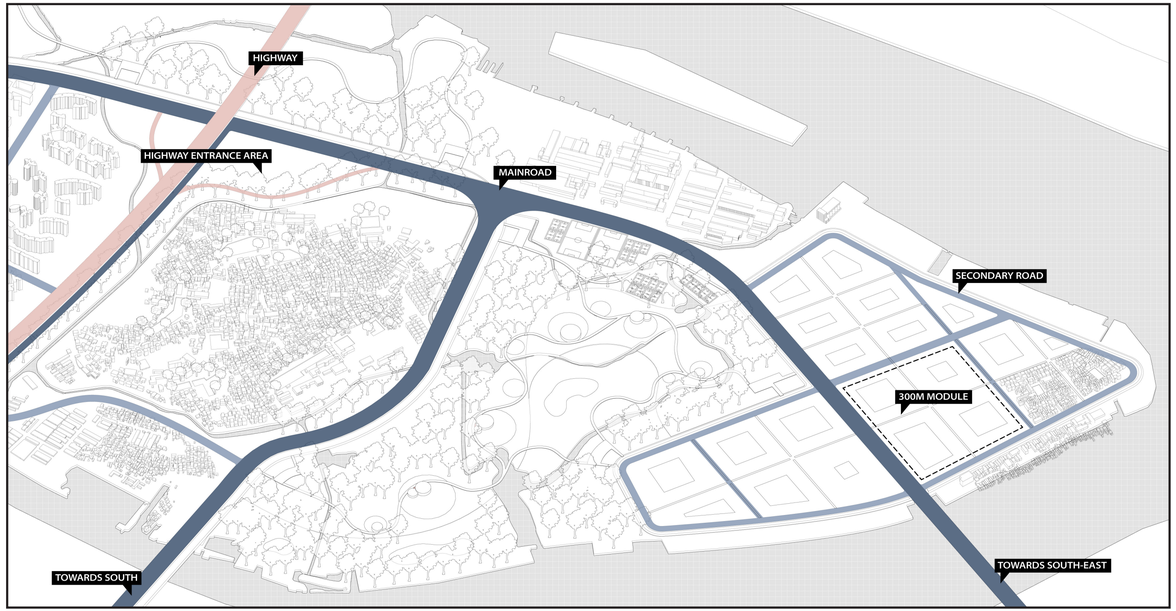
WETLAND PARK IN NORMAL SITUATION

WETLAND PARK IN FLOODING SITUATION

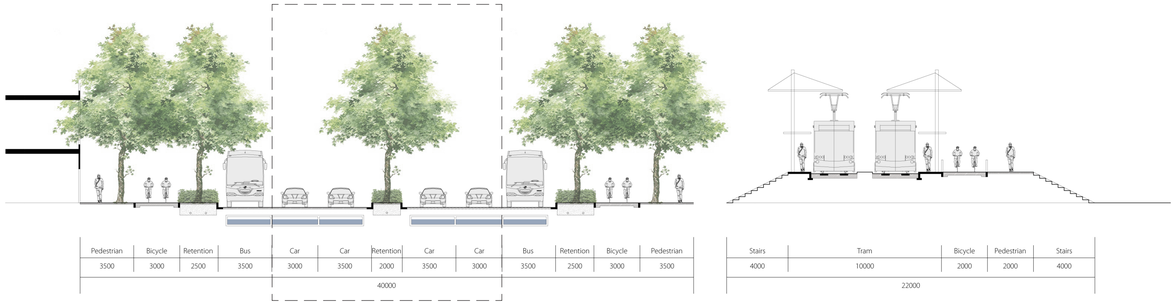


NETWORK LAYER

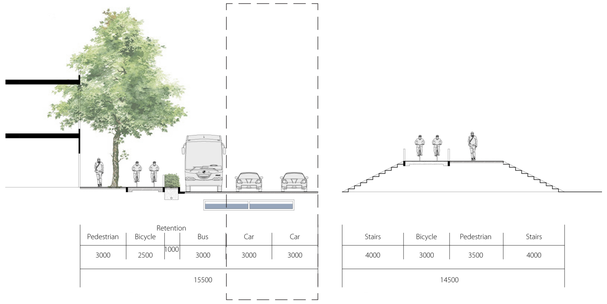
INCREASE FAST TRAFFIC NETWORK DENSITY



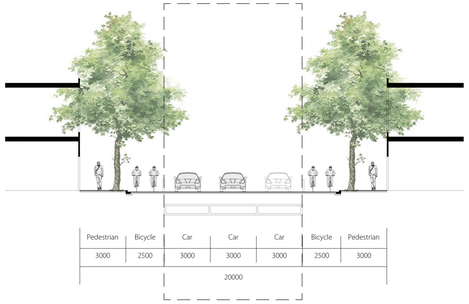
SECTIONS



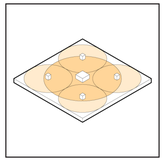
MAIN ROAD + DIKE
SCALE 1:200



SECONDARY ROAD + DIKE
SCALE 1:200

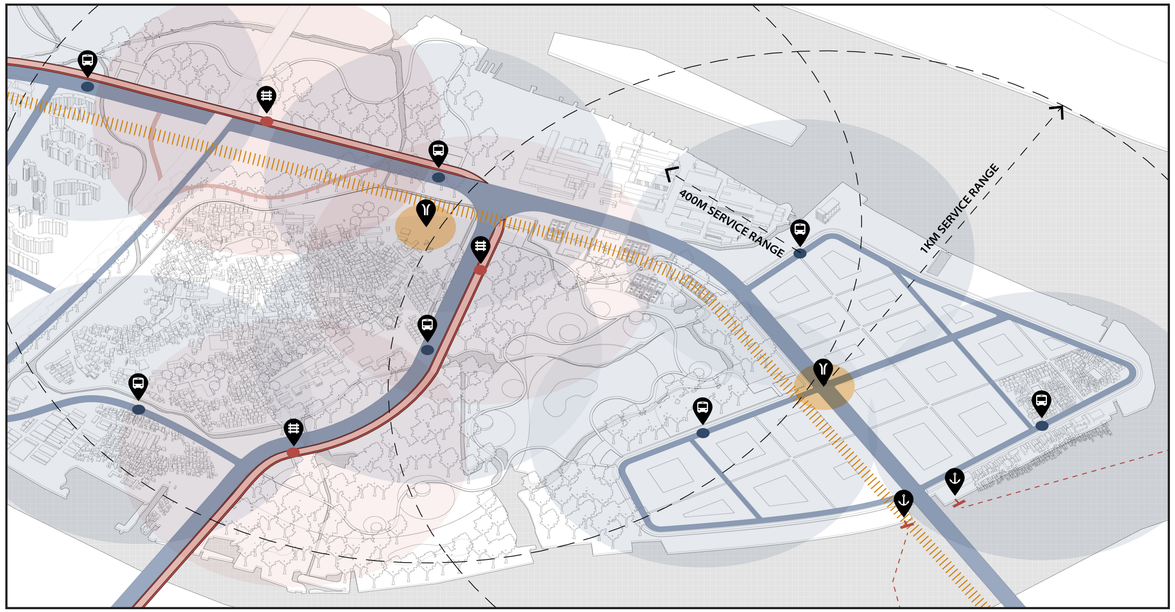


SECONDARY ROAD
SCALE 1:200

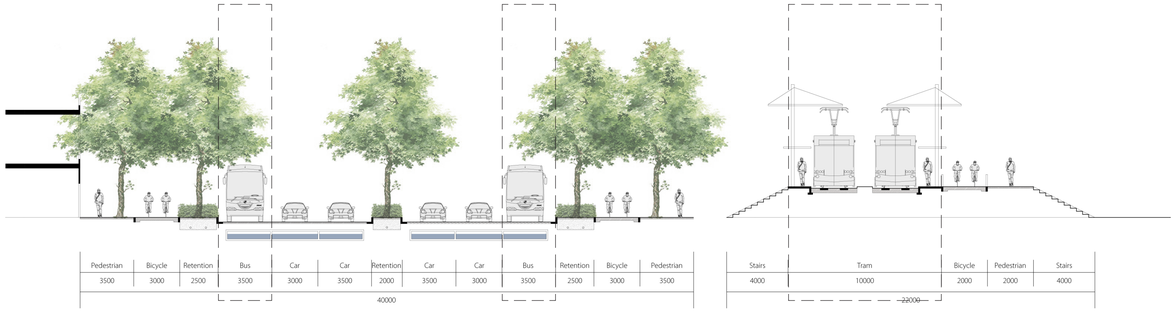


NETWORK LAYER

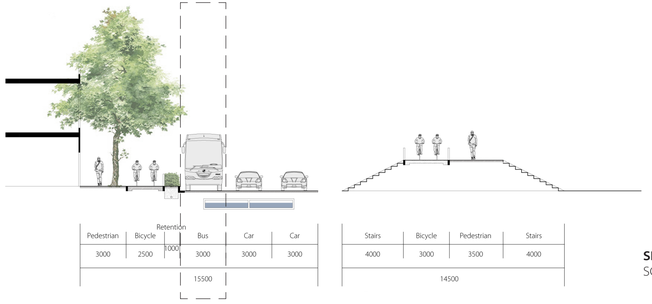
MULTIPLE PUBLIC TRANSPORT NETWORKS



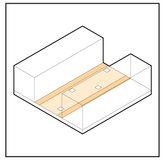
SECTIONS



MAIN ROAD + DIKE
SCALE 1:200

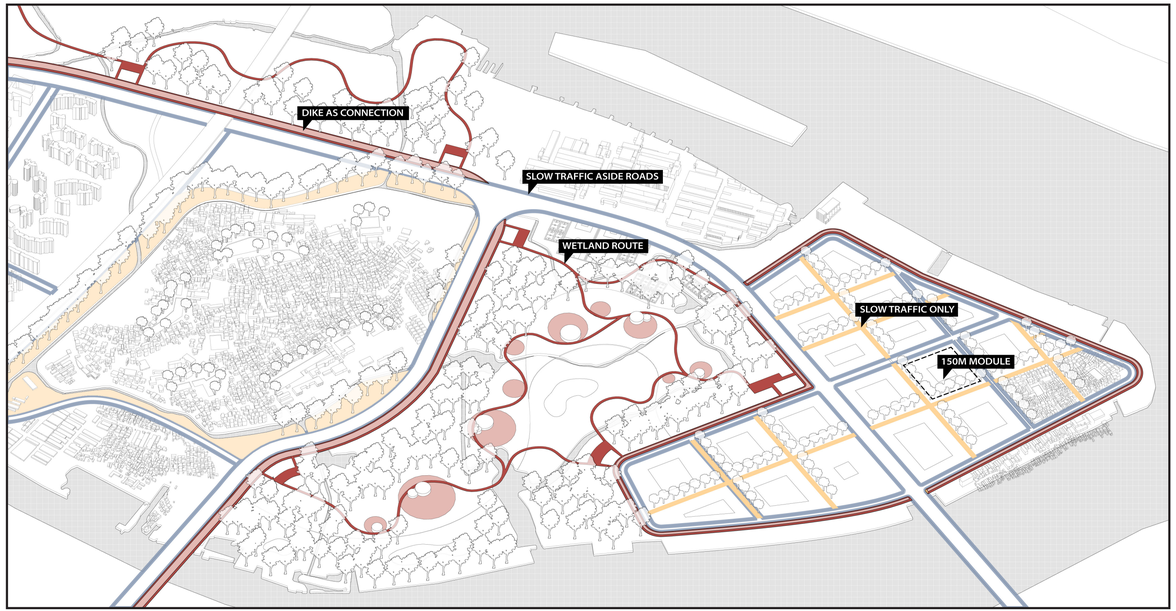


SECONDARY ROAD + DIKE
SCALE 1:200



NETWORK LAYER

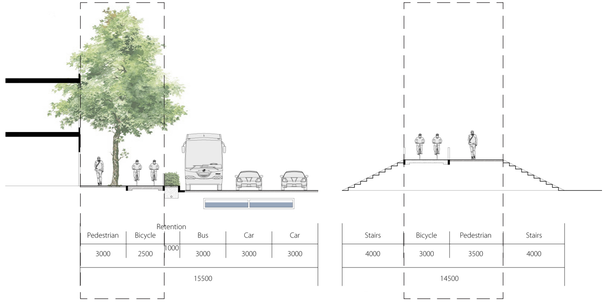
SLOW TRAFFIC & WALKABLE NEIGHBORHOODS



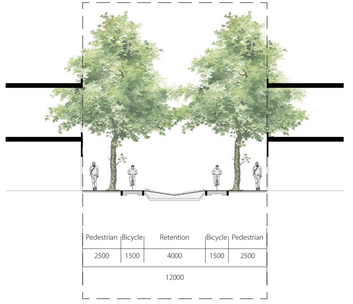
SECTIONS



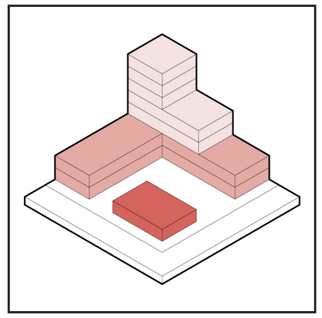
MAIN ROAD + DIKE
SCALE 1:200



SECONDARY ROAD + DIKE
SCALE 1:200

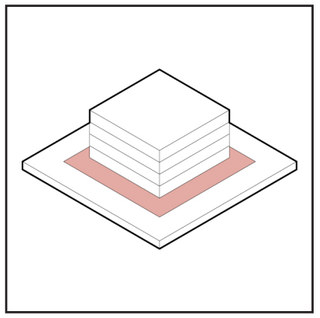


WALKABLE NEIGHBORHOOD
SCALE 1:200



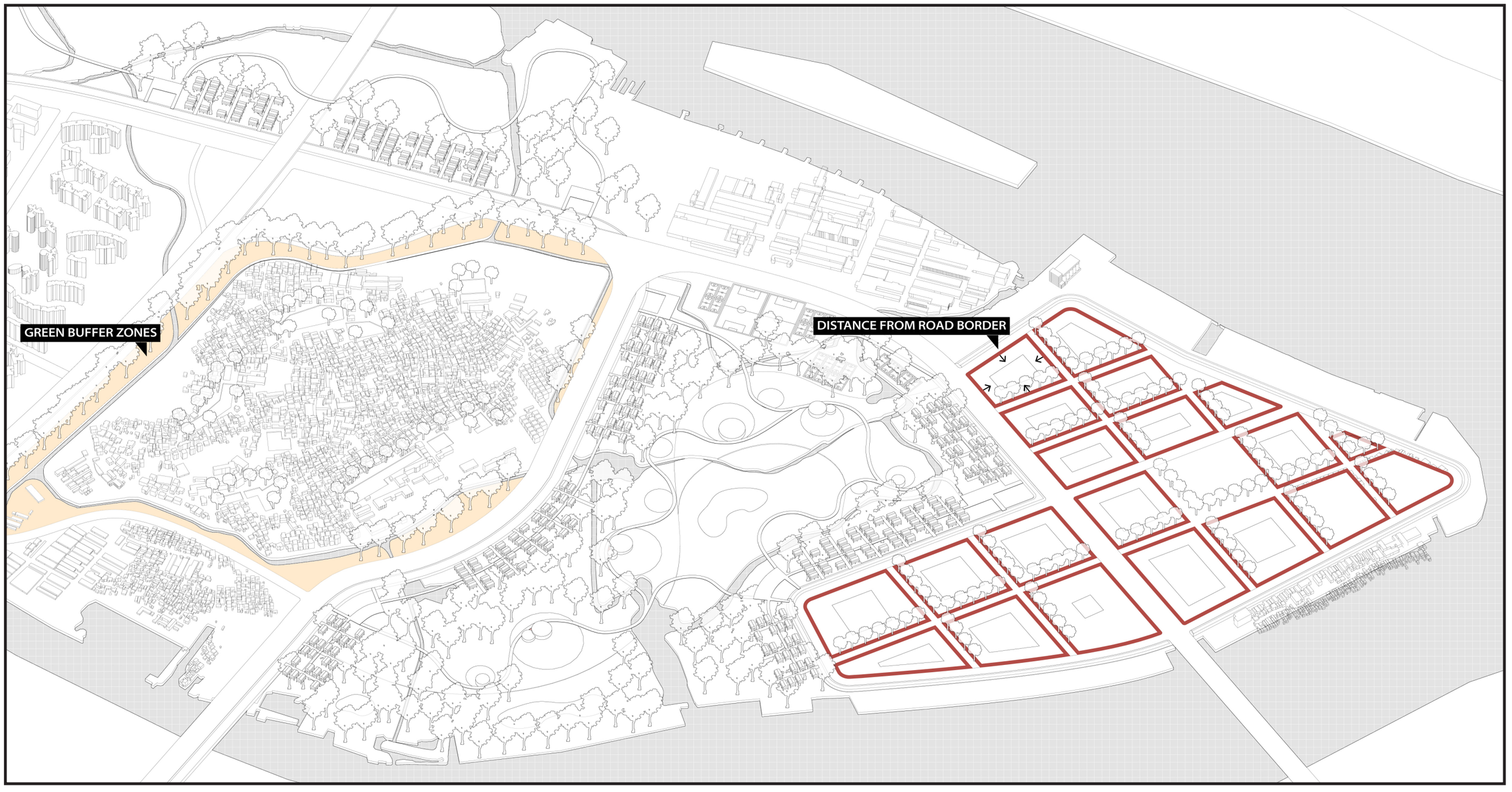
URBAN SETTLEMENT LAYER

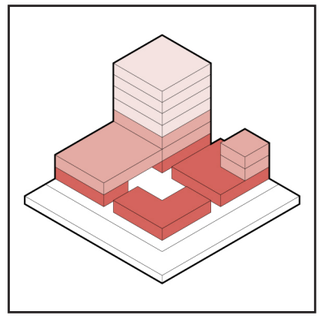
MULTIPLE FUNCTIONAL NEIGHBORHOODS



URBAN SETTLEMENT LAYER

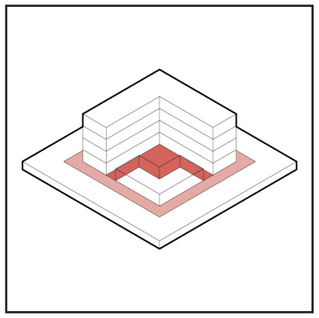
CREATING BUFFER ZONE





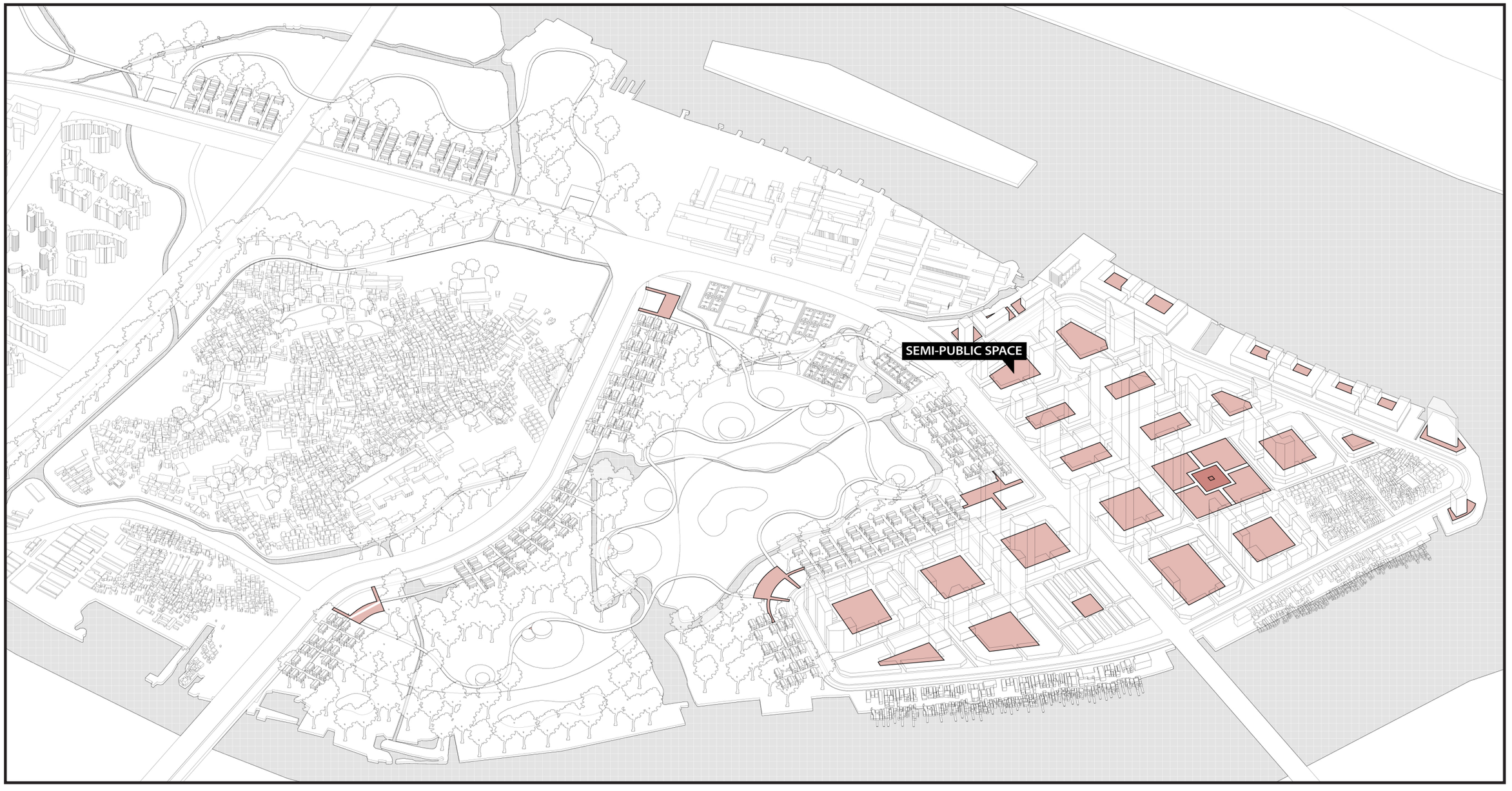
URBAN SETTLEMENT LAYER

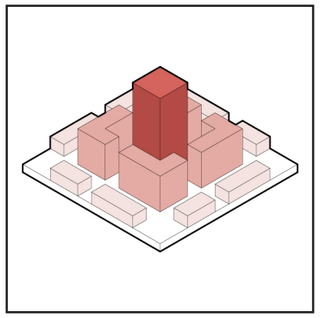
MIX TYPES OF BUILDINGS



URBAN SETTLEMENT LAYER

SEMI-PUBLIC SPACE

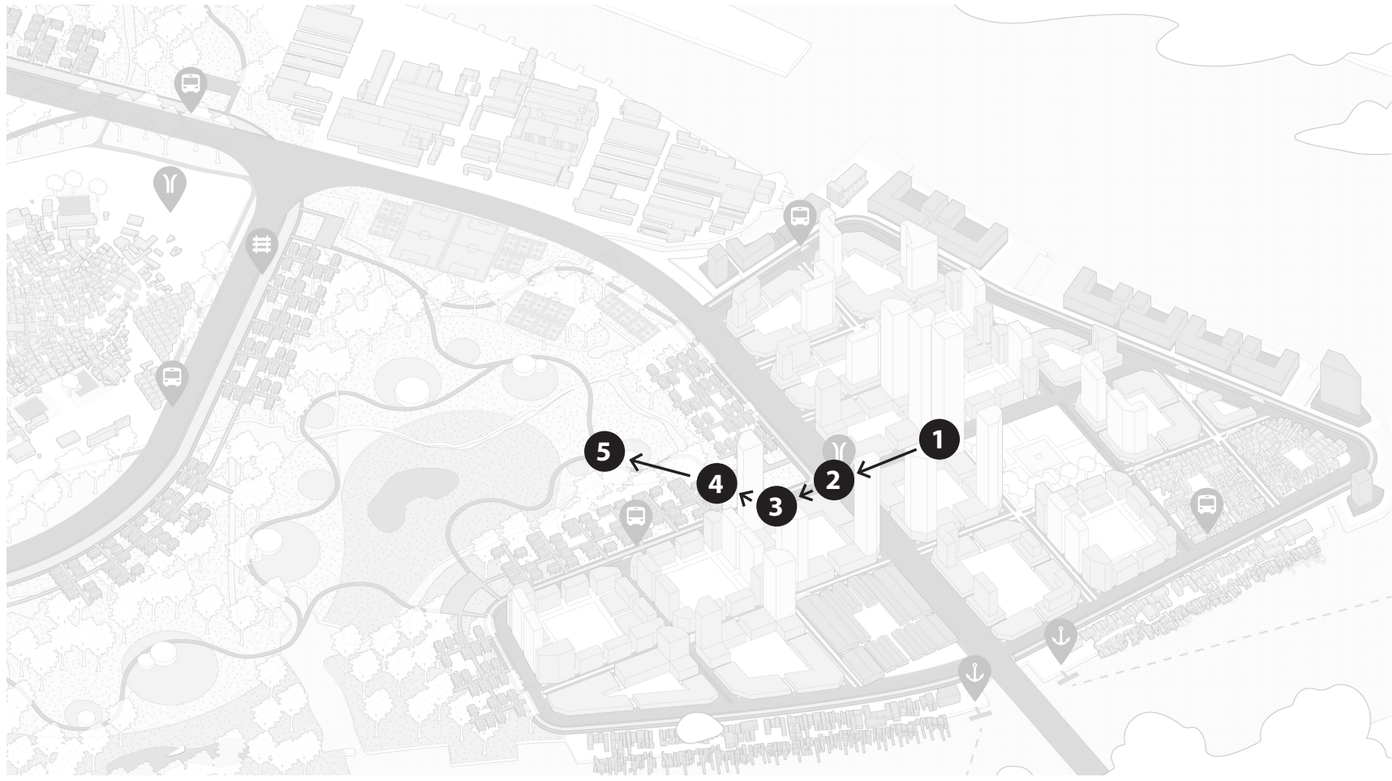




URBAN SETTLEMENT LAYER

HEIGHT & VIEW CONTROL

SPATIAL TRANSITION FROM URBAN TO WETLAND



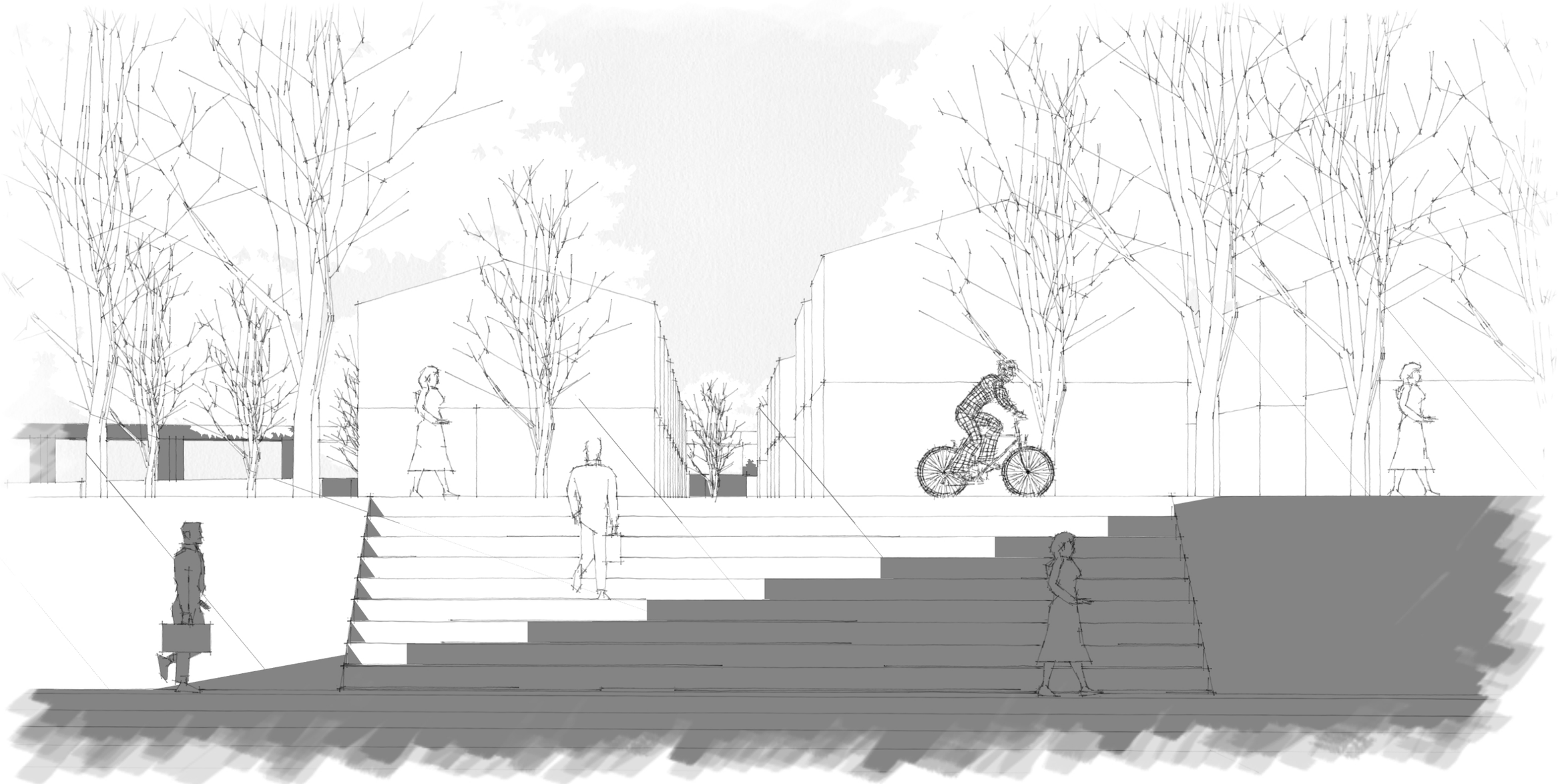
1 URBAN CENTER



2 CLOSE TO THE BORDER



3 WALK ON TO THE DIKE



4 ENTRANCE PLATFORM OF WETLAND PARK



5 INTO THE WETLAN PARK



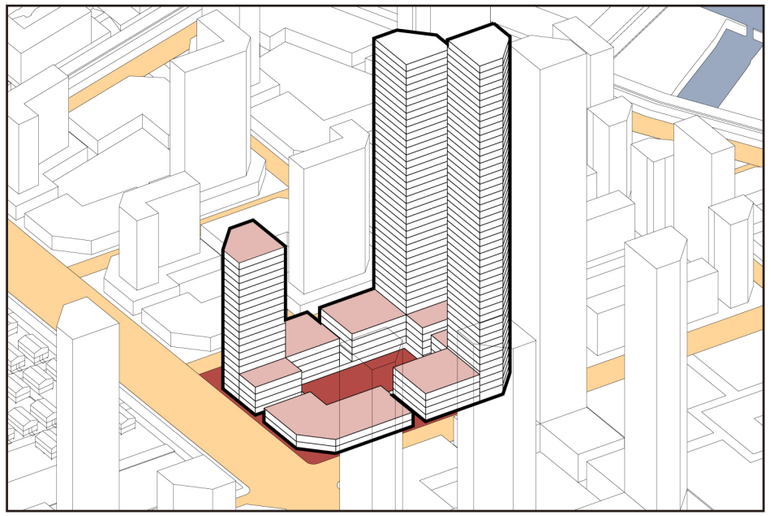
URBAN TYPOLOGIES - INNER DIKE

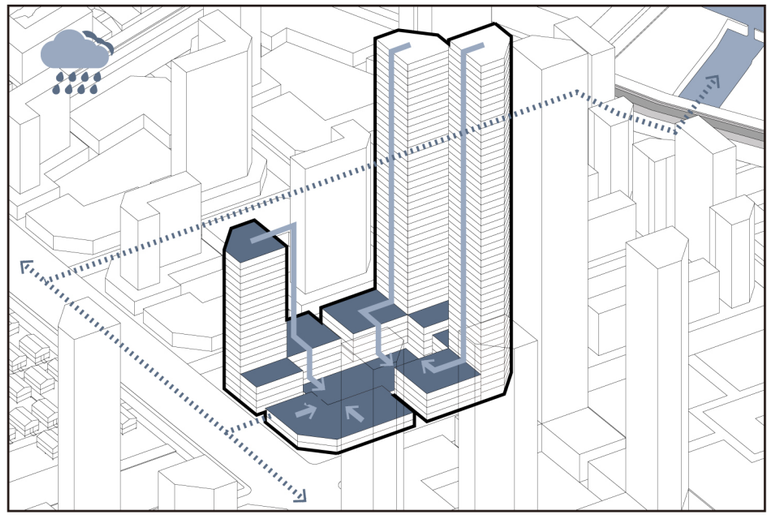
SPATIAL STRUCTURE

RETENTION SYSTEM

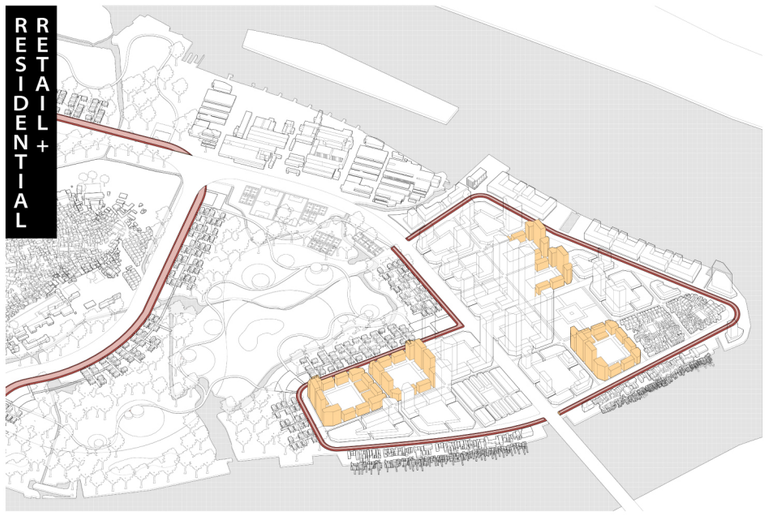
RESIDENTIAL RETAIL+ COMMERCIAL/

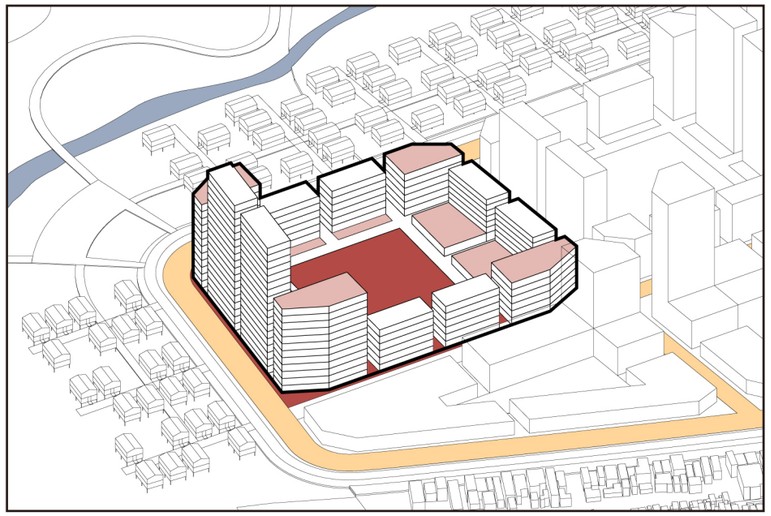


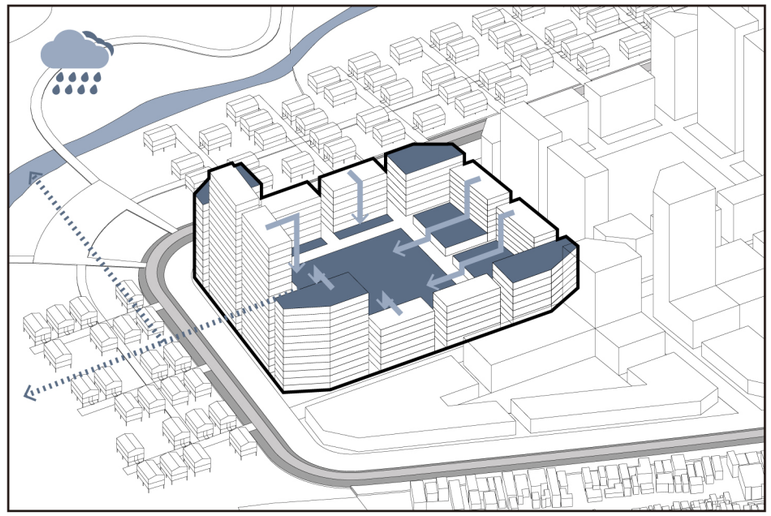




RESIDENTIAL RETAIL+

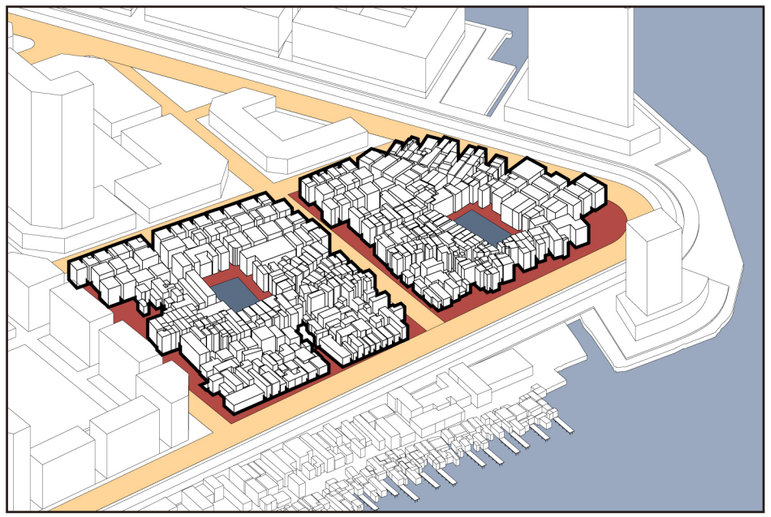


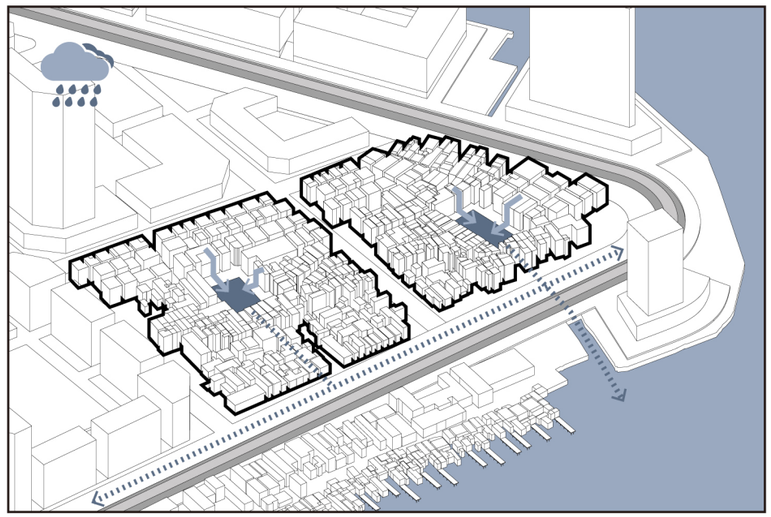




URBAN VILLAGE RETAIL+







INNER DIKE RAINWATER RETENTION NEIGHBORHOOD

NORMAL SITUATION

INNER DIKE RAINWATER RETENTION NEIGHBORHOOD

HEAVY RAIN

INNER DIKE RAINWATER RETENTION NEIGHBORHOOD

EXTREME STORM

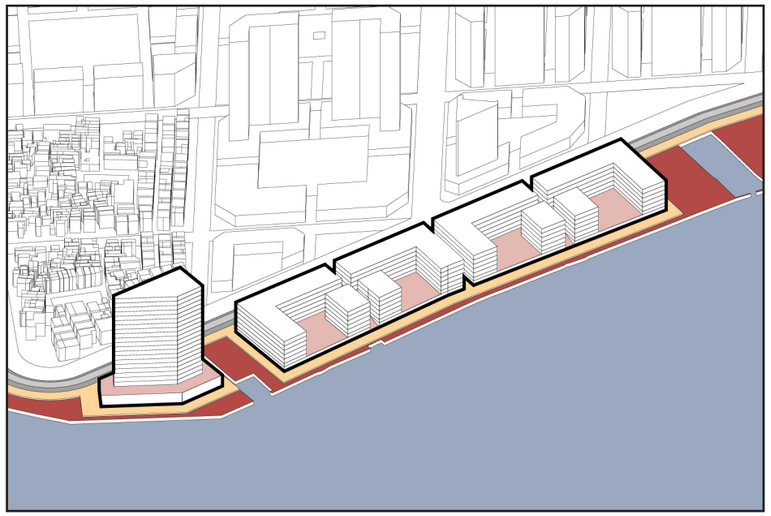
URBAN TYPOLOGIES - OUTER DIKE

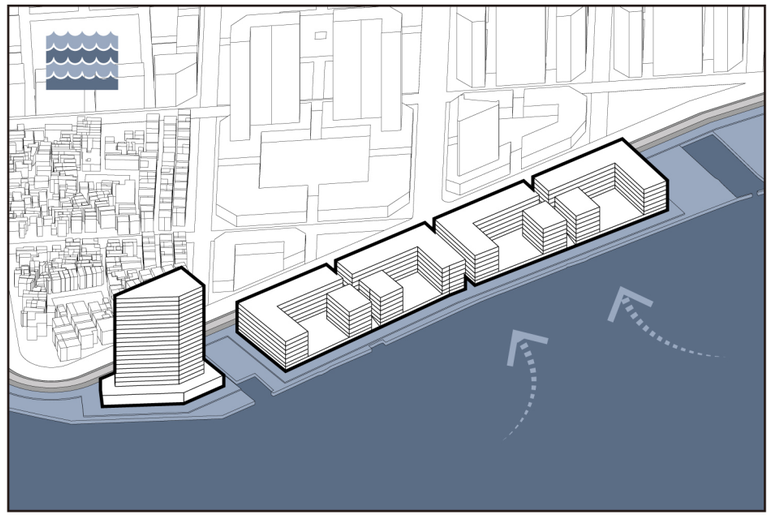
SPATIAL STRUCTURE

FLOOD TOLERANT

RESIDENTIAL + RETAIL

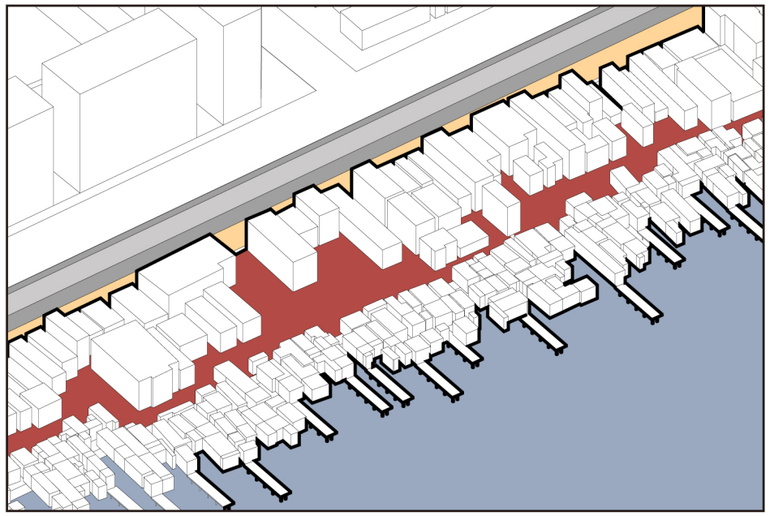


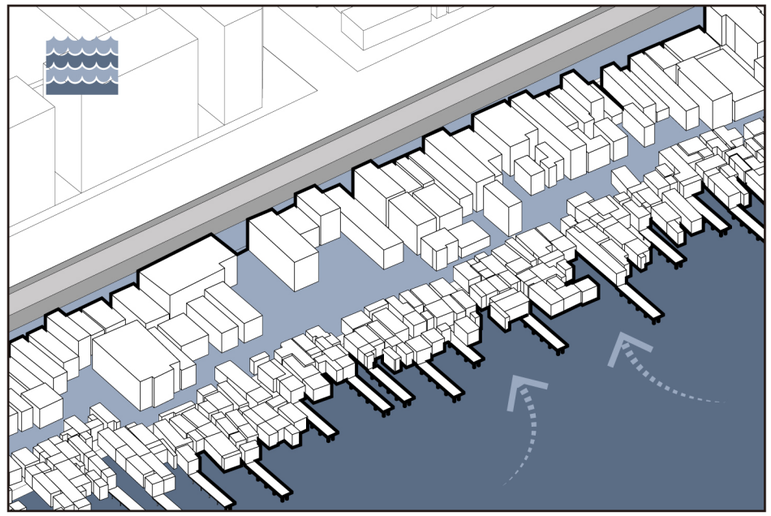




FISHING PLATFORM + RESIDENTIAL

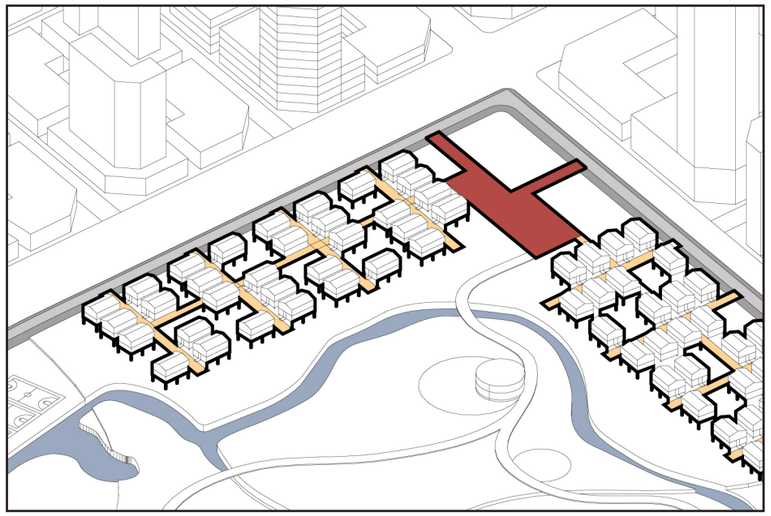


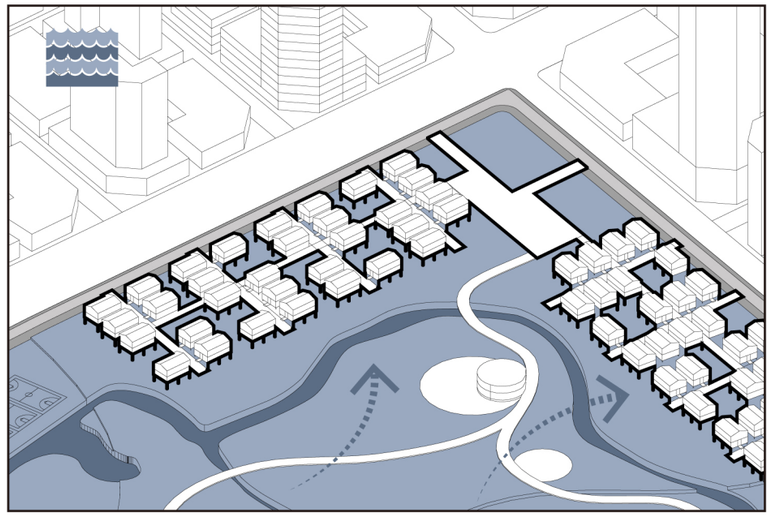




WETLAND RESIDENTIAL +







OUTER DIKE FLOOD TOLERANT NEIGHBORHOOD

NORMAL SITUATION

OUTER DIKE FLOOD TOLERANT NEIGHBORHOOD

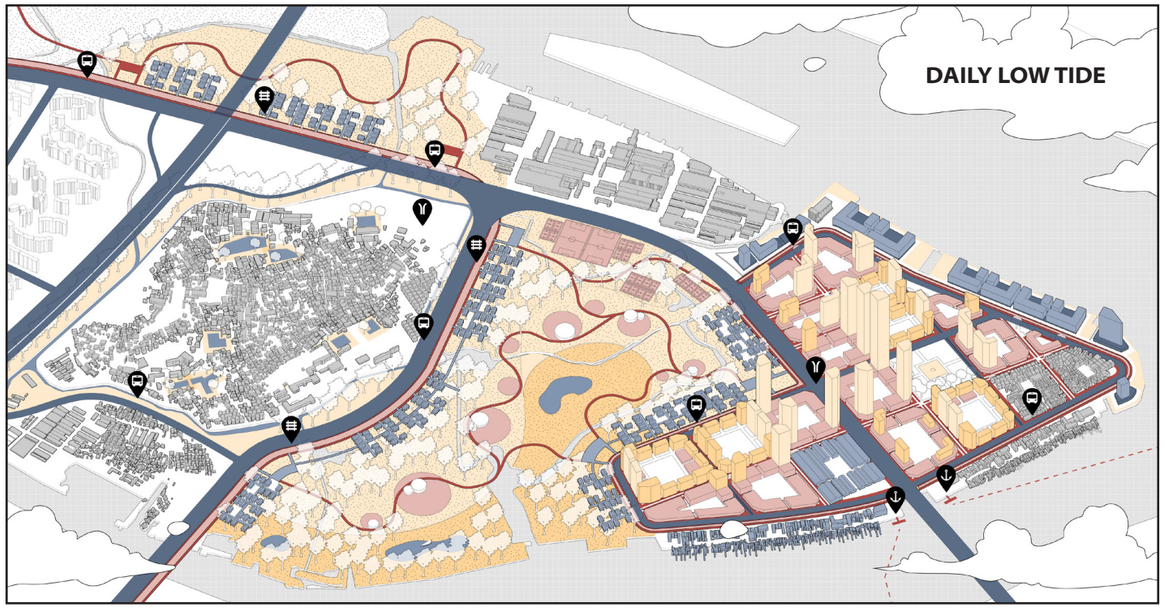
HEAVY RAIN

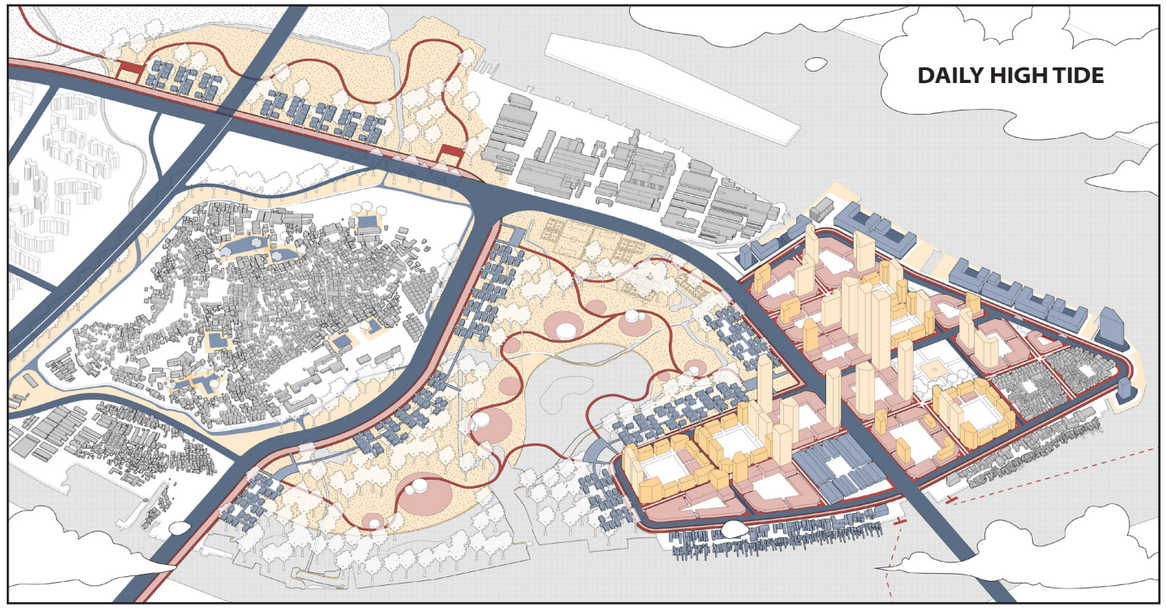


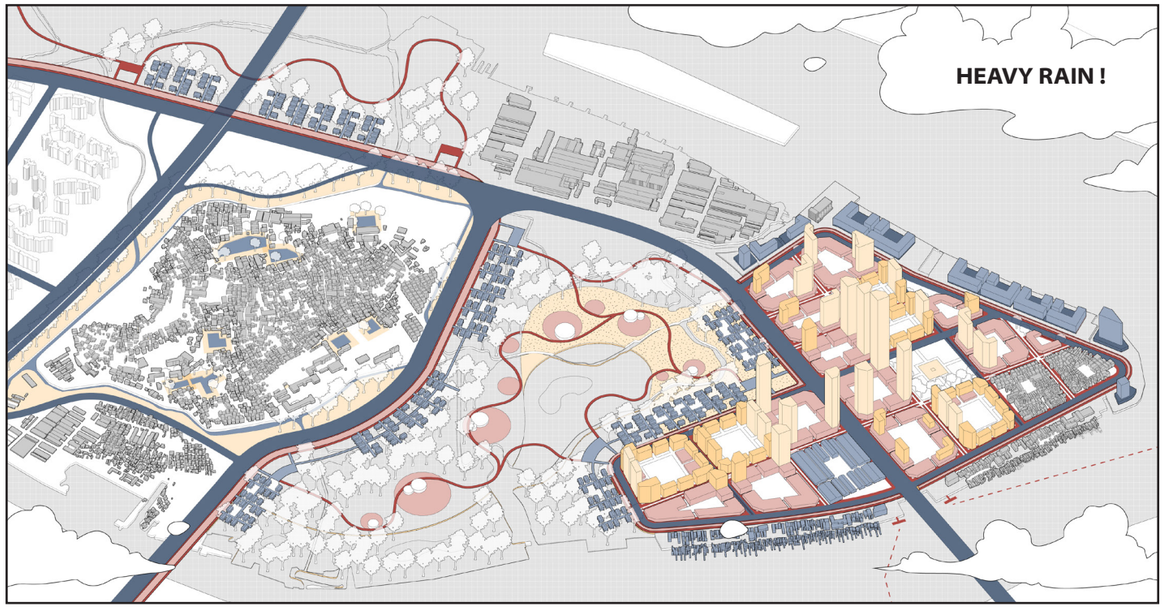
OUTER DIKE FLOOD TOLERANT NEIGHBORHOOD

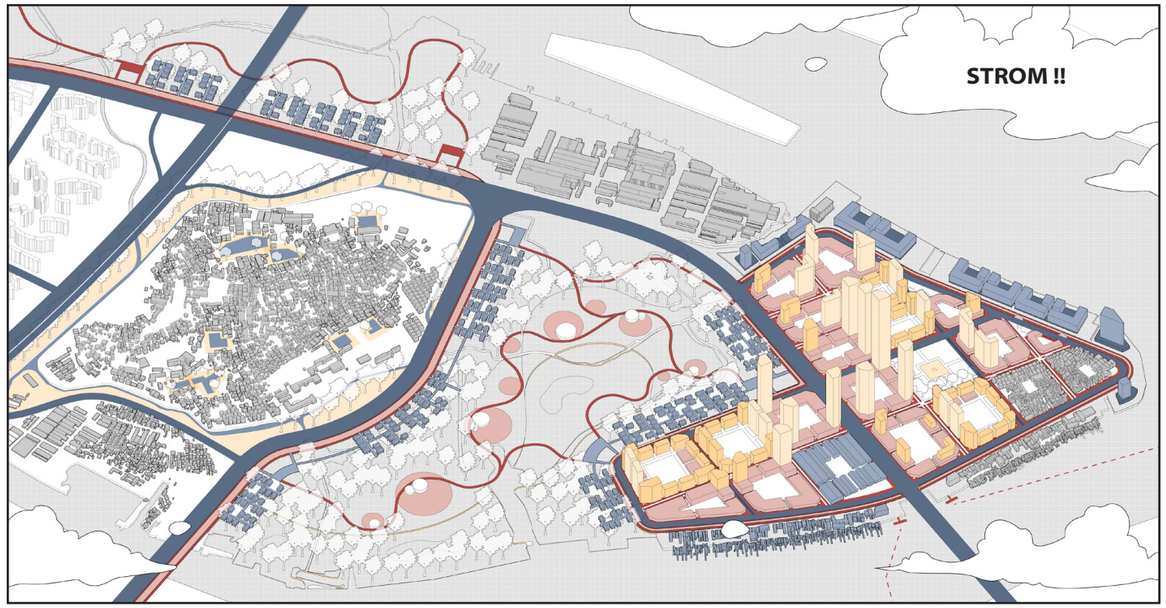
EXTREME STORM

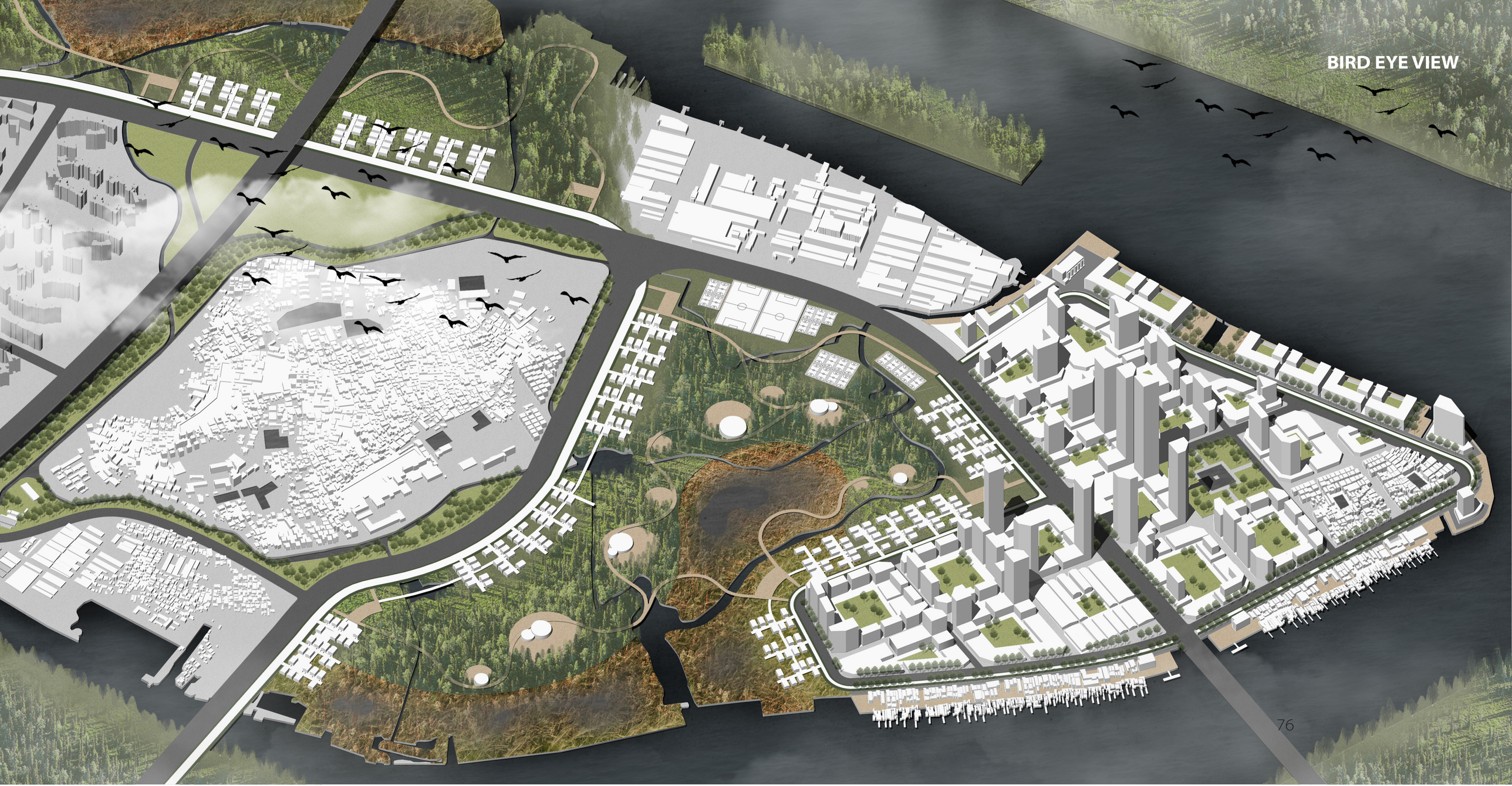
THE CHANGING WATER LEVELS







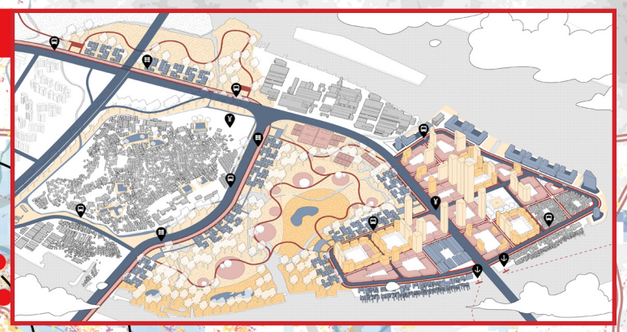




BIRD EYE VIEW

BEYOND A SITE-SPECIFIC DESIGN

PAZHOU AS A SAMPLE





DESIGN EXPLORATION AS A SAMPLE FOR OTHER AREAS UNDER FLOODING RISKS IN THE FUTURE URBAN EXPANSION AREAS.



THANK YOU

WATER RESILIENT AND ADAPTIVE DEVELOMENT OF PAZHOU ISLAND

Pearl River Delta Graduation Lab
P5 Presentation

Jiajun Wu

TU Delft