

THE YUDAI (Jade-Ribbon) RIVER | RESILIENT CAMPUS IN GREEN INFRASTRUCTURE OF DRAINAGE
ZHENJIANG , CHINA



THE YUDAI (Jade-Ribbon) RIVER | RESILIENT CAMPUS IN GREEN INFRASTRUCTURE OF DRAINAGE , ZHENJIANG , CHINA



Zhenjiang : located on the south bank of the Yangtze River



Jade-ribbon River • Zhenjiang

PROJECT STATEMENT

The Yudai(Jade-Ribbon) River stretches from Mengjiawan Reservoir in the west to the ancient canal in the east, which is the main drainage channel in Jingkou District of Zhenjiang City, and is also an important landscape river in Mengcheng, Dongfeng, Dantu communities and Jiangsu University. Since 2016, the the small watershed of Jade Belt River has been comprehensively renovated. In cooperation with the sponge transformation of Jiangsu University and the construction of Mengjiawan Reservoir, a continuous effect has been formed to ensure urban water security, improve the environment of urban water, and comprehensively solve regional problems with systematic planning and reasonable implementation measures.

As a pilot project to build a “Sponge City” in Zhenjiang City, it realizes the whole process of "source-process-end" governance, positively affects the hydrological cycle of the river basin, and reduces the frequency and degree of downstream waterlogging disasters. In addition, the project also integrates blue-green infrastructure with open spaces in campuses and communities to reduce the floor space and cost of stormwater facilities, and provide sustainable development strategies for schools and surrounding communities.

PROJECT NARRATIVE

Background

Zhenjiang, with rich waters and mountains, has the natural chasm of the Yangtze River and is the headstream of Wu culture in the Three Kingdoms, gathering the three major water systems of the Yangtze River, Qinhuai River and Taihu Lake. Today, this old city with a high density in the rainy region of the south has encountered some problems including limited construction and development space, weak water system infrastructure, and severe waterlogging during rainy periods. In order to solve these water environment problems in urban areas and combining the urban rainwater and water system management concepts and technical methods of many developed countries, China proposes the concept of “Sponge City” . Sixteen cities, including Zhenjiang, became the first batch of pilots in 2015.

The Jade-Ribbon River is the main drainage channel of one of the 11 independent catchment zones in the pilot area, with a catchment area of about 392.39hm², originating from the Mengjiawan Reservoir and flowing east into the ancient canal, with a total length of 2.8 kilometers. In 2016, entrusted by the owner, we worked with our partners to complete the comprehensive treatment project the small watershed of the Jade-Ribbon River , adopting a systematic plan including source reduction, process diversion, terminal treatment, landscape improvement, and community revitalization, and jointly using green and gray facilities to in order to eliminate the black and odorous water of the river to improve the overall environment.

Key Issues

Issues of water environment in the watershed

There are problems such as insufficient water supply, pollution of surrounding household garbage , the affluxion of municipal rainwater drainage on both sides of the bank, small and almost flat river drops, and insufficient hydrodynamics. In addition, the narrowest part of the middle and lower reaches of the rainfall flood period is only 6 meters, and the river channel has insufficient capacity of drawing off floodwater, resulting in waterlogging in the low-lying areas of the school and surrounding communities.

Campus’s needs for development

The terrain of Jiangsu University is complex and large, with a total area of about 1.5km², accounting for 40% of the entire catchment area, which is an important component to achieve the goal of transforming catchment area of the Jade Belt River. However, as the largest receiving water and landscape river on campus, the Jade Belt River has a "negative space" that separates the campus due to its straight and rigid shoreline, narrow river channel, water quality and quantity, and waterlogging problems.

Overall Goal

The concept of a single LID facility practices the whole-process governance thinking of "source reduction-process triage-end treatment" for the first time, combined with corresponding calculation methods, including model method, volume method, empirical formula method and other methods to make progressive efforts, thus deriving corresponding control indicators.According to the field conditions, the treatment goals to be achieved by the project including the followings:

- The total annual runoff control rate reaches 75%
- Reduction of non-point source pollution reaches 60%
- Drainage and standard of waterlogging prevention reaches the highest level in 30 years
- River water quality reaches the Class IV surface water discharge standard.
- The rainwater pipes and channels effectively cope with rainfall of 36 to 45 millimeters per hour

Thus ensuring safety of urban water, improving the urban water environment, and comprehensively solving regional problems with systematic planning and reasonable implementation measures.

Main Strategies

- Innovatively apply the whole-process governance concept of "source-process-end" to positively influence the hydrological cycle of the river basin and reduce the frequency and degree of downstream waterlogging disasters.
- By comprehensively applying the conventional calculation design and model analysis and verification, the top-level design of the Jade Belt River area was carried out, forming a project package with optimal economy and technology and strong implementability so as to verify and evaluate the construction effect of the project.
- Optimize the structure of biological detention facilities, and use technologies such as source LID, multi-stage biological filters, and high-load gravity flow wetlands to collect and purify rainwater.
- Integrate gray and blue infrastructure with green and open space in the area to provide sustainable development strategies for the construction of schools and surrounding communities.

Results Achieved

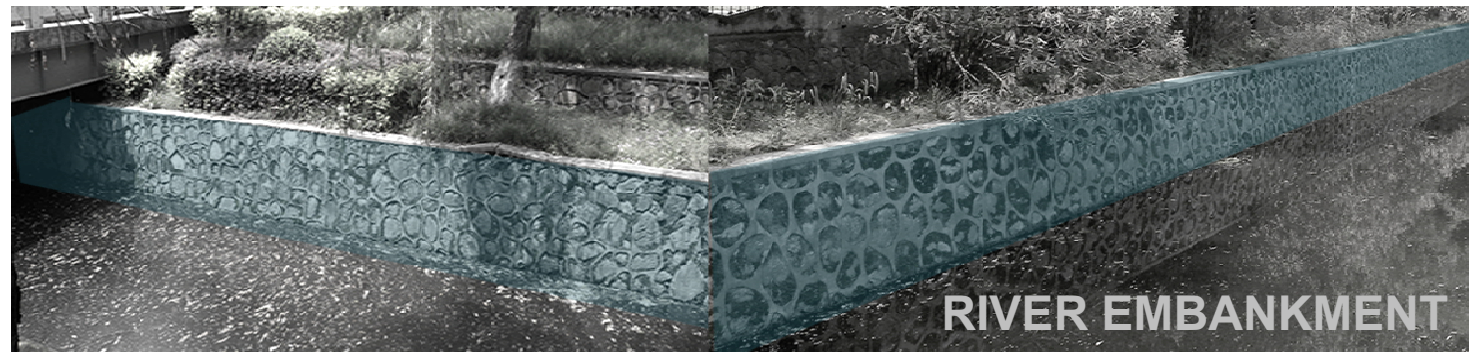
The implementation of the project serves multiple purposes, such as managing floods, increasing biodiversity and providing space for teaching, scientific popularization and recreation. At the same time, the beautiful landscape of the riverbank cultivates people's sense of belonging to the river, which allows people to have closer contact with the water and the river and begin to enjoy and protect the river, thus improving the residents' sense of responsibility for the environment. And it also bring more opportunities for the development of the construction area and the surrounding urban areas, and have important social, cultural and economic significance.



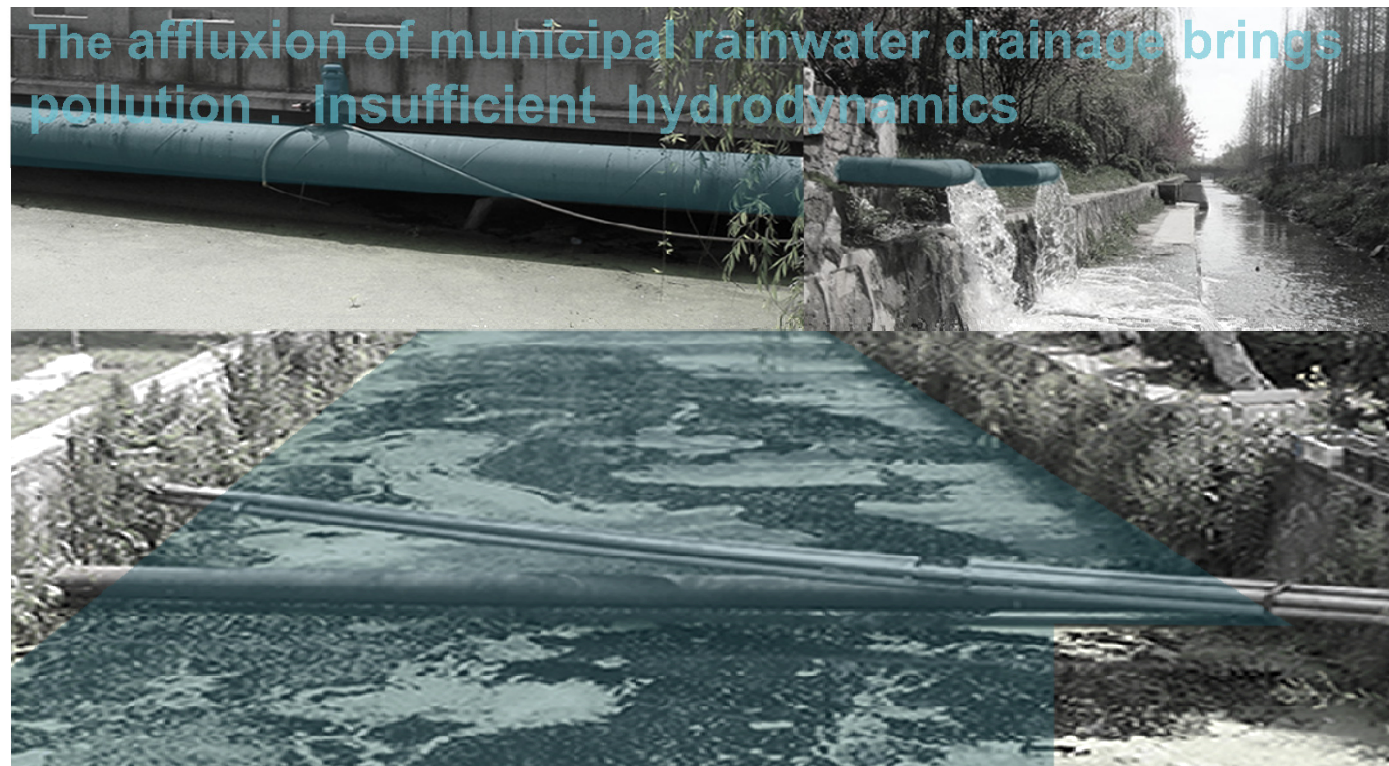
SEWAGE DISCHARGED INTO THE RIVER



POOR CLASS V WATER QUALITY
WATER BLOOM



RIVER EMBANKMENT



The affluxion of municipal rainwater drainage brings pollution . Insufficient hydrodynamics



OBSOLETE FACILITIES

Jade-Ribbon River as the largest receiving water and landscape river on campus, it has a "negative space" that separates the campus due to its straight and rigid shoreline, narrow river channel, water quality and quantity, and waterlogging problems.

THE CHALLENGE:

Outdated infrastructure, crowded campus space, and traditional campus landscaping make it difficult to meet the needs of students and faculty and the future development of the university.

However, the increasing number of buildings, roads and other impervious areas, old pipeline facilities, etc. have become the main cause of frequent flooding.

THE OPPORTUNITY :

Taking this opportunity to combine the comprehensive goals, the Jade-Ribbon River can be used as a link to realize the campus environment from internal optimization to regional sharing.

MASTER PLAN



0 100 250 500m

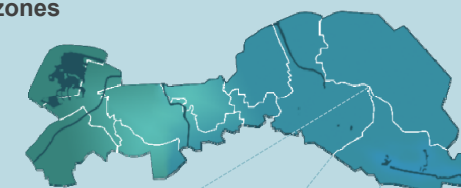


control indicators practical effect

The total annual runoff control rate	75%	79.8%
Reduce non-point source pollution	60%	74.04%
Drainage and flood control standards	30 years	30 years
River water quality	Class IV	Class IV
Effectively cope with rainfall	36 - 45 mm/h	36 - 45 mm/h

Overall Goal Integrates blue-green infrastructure with open spaces in campuses and communities to reduce the floor space and cost of stormwater facilities, and provide sustainable development strategies for schools and surrounding communities.

11 catchment zones



The catchment zone of Jade-ribbon River is about 392.39 hm²



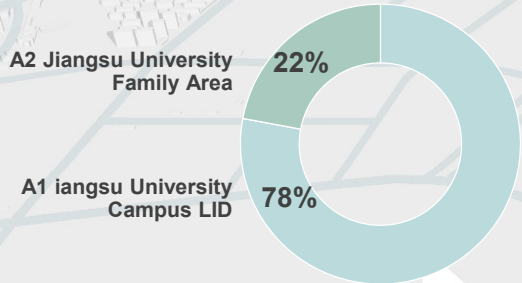
The river is main drainage channel with a total length of 2.8km

LEGEND

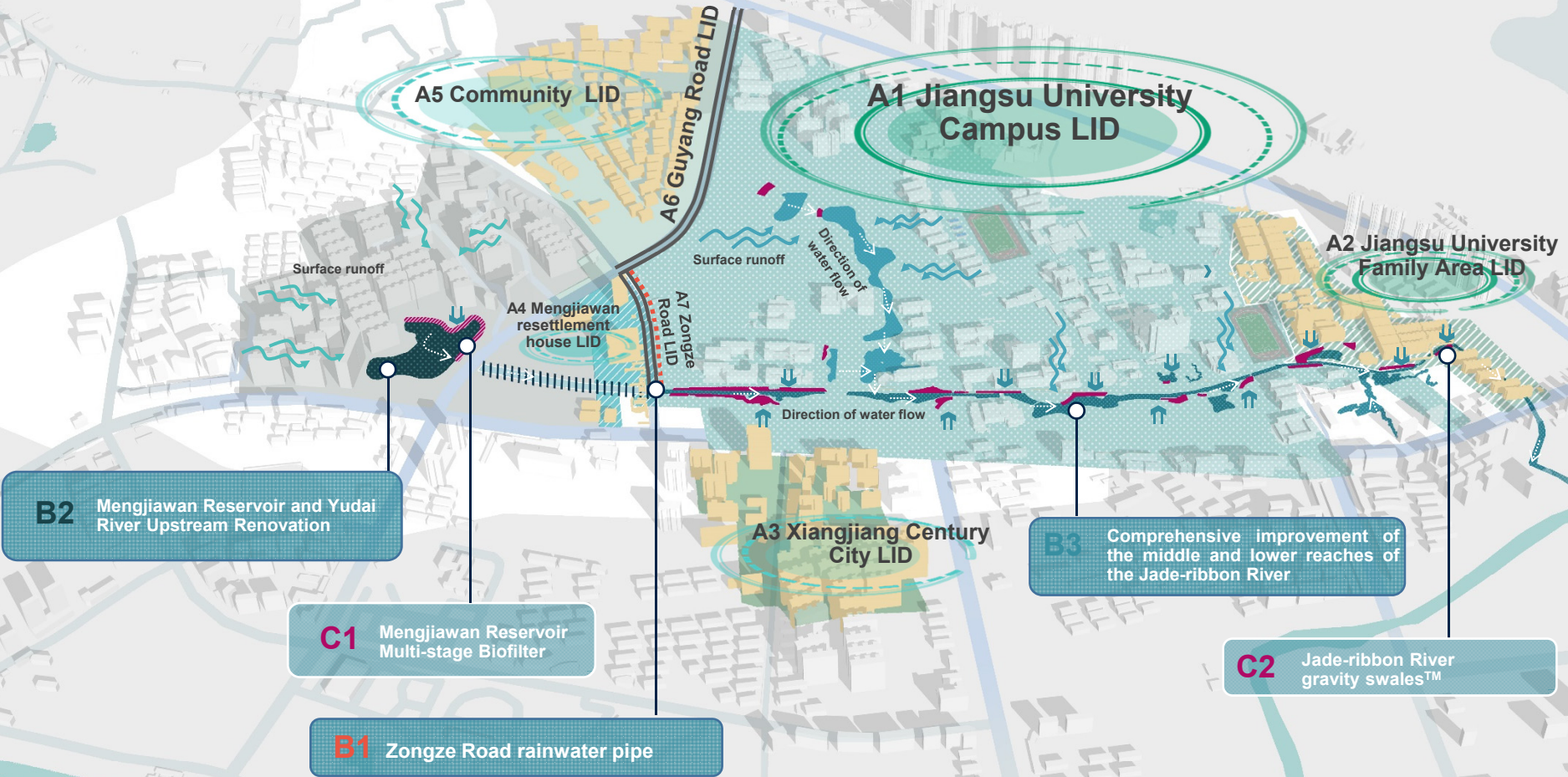
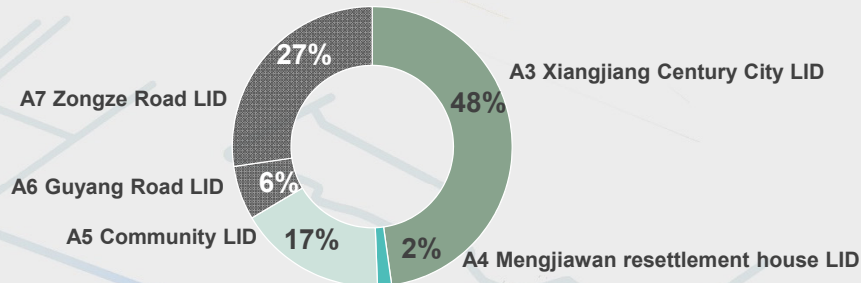
- 01 MENGJIAWAN RESERVOIR
- 02 WATER PURIFICATION WETLAND
- 03 BUYE RIVER PARK
- 04 MAIN ENTRANCE SQUARE
- 05 RIVERBANK CORRIDOR
- 06 RIVER VIEW THEATER
- 07 RIVERSIDE TRAIL
- 08 LOTUS POND
- 09 FLOOD STORAGE LAKE
- 10 CELEBRATION SQUARE
- 11 BREEZE PLAZA
- 12 RAIN GARDEN
- 13 FITNESS PLAZA
- 14 FISHING PLATFORM
- 15 ECOLOGICAL REVETMENT
- 16 MIRROR LAKE

SYSTEMATIC LAYOUT

Percentage of source LID transfer volume on campus



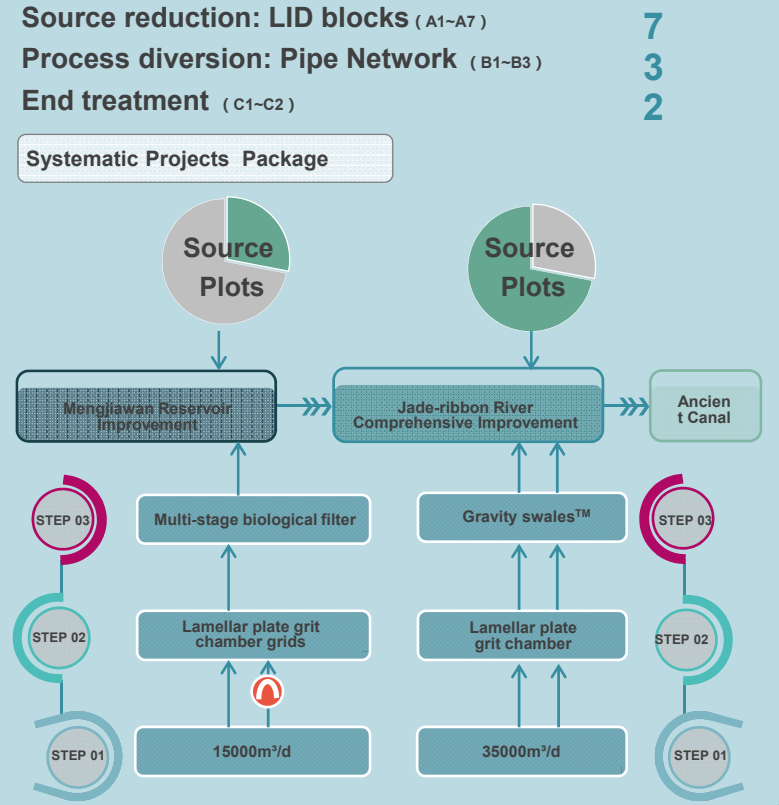
Percentage of source LID transfer volume off campus



Main Strategies Apply the whole-process governance concept of “Source (Reduction) - Process (Diversion) – End(Treatment)” to positively influence the hydrological cycle of the river basin.

This catchment zone consists of 12 projects, with the **Jade-Ribbon River water environment remediation as the core**. Completed 2,041,100m² Sponge transformation of the source plot to achieve 17,700m³ Rainwater storage capacity. a continuous effect has been formed to ensure urban water security, improve the environment of urban water, and comprehensively solve regional problems with systematic measures.

Systematic projects include: LID transformation of Jiangsu University and its employee residence at the source construction of Mengjiawan Wetland Park (including multi-stage bio filter 15000m³/d), construction of gravity flow wetland along the Jade-Ribbon River, river widening and shoreline creation, etc.



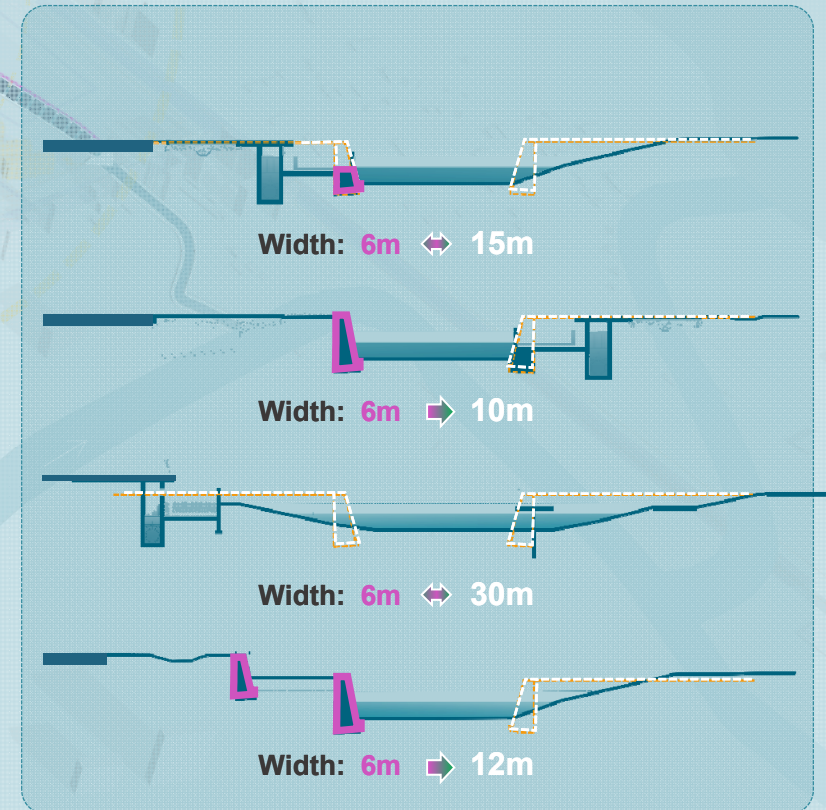
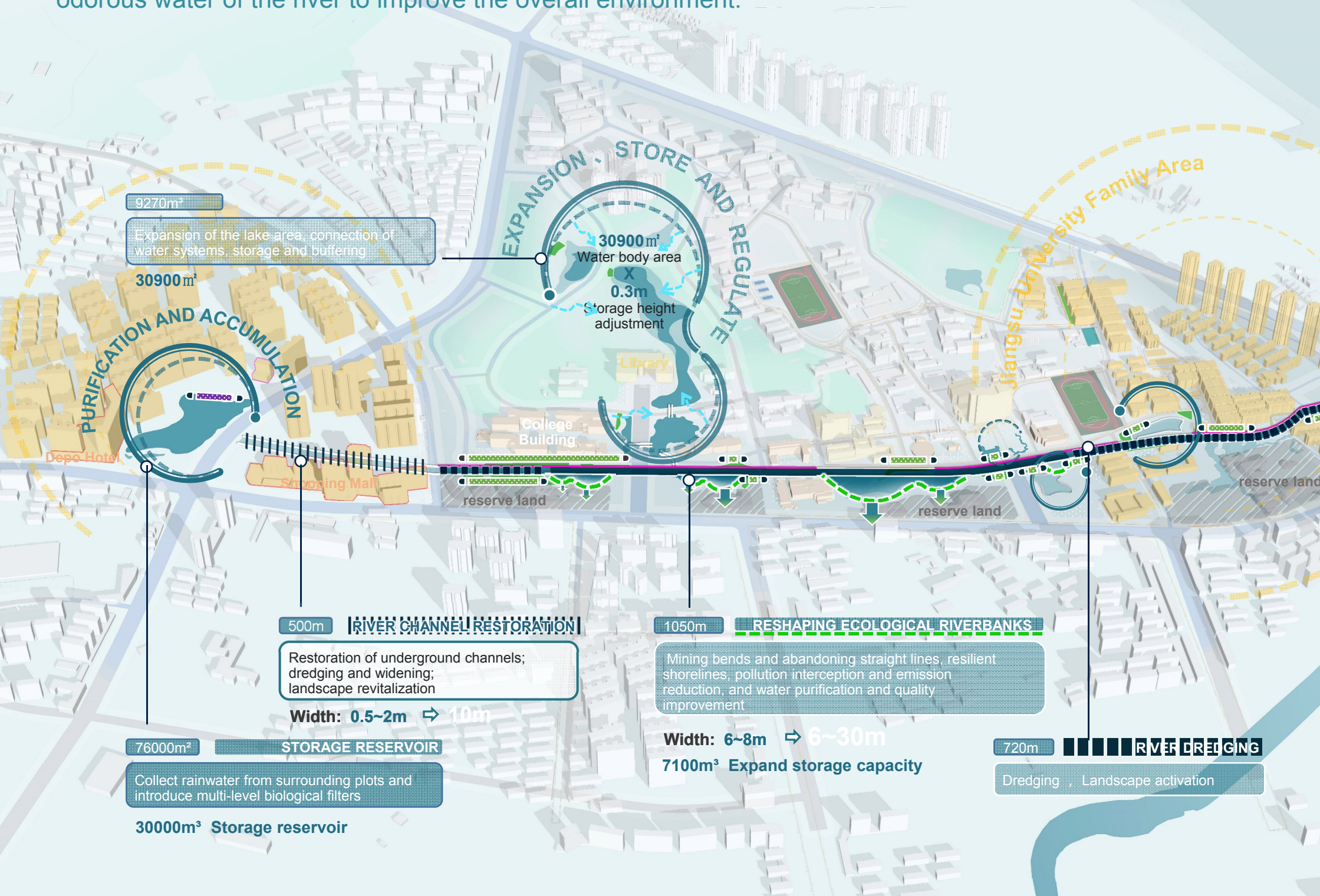
SMALL-WATERSHED MANAGEMENT

Main Strategies In cooperation with the sponge transformation of Jiangsu University and the small watershed management of Jade-Ribbon River, in order to eliminate the black and odorous water of the river to improve the overall environment.

2.04 km² **17800 m³**
Renovation area Expansion of water storage capacity

1.8 km Reconstruction of riparian zone
84070 m² Campus reserve land
40000 Beneficial population

- **1 Multi-stage Biofilter**
-- Daily processing capacity 15000m³/d
- **12 High Load Gravity Swales**
-- Daily processing capacity 35000m³/d






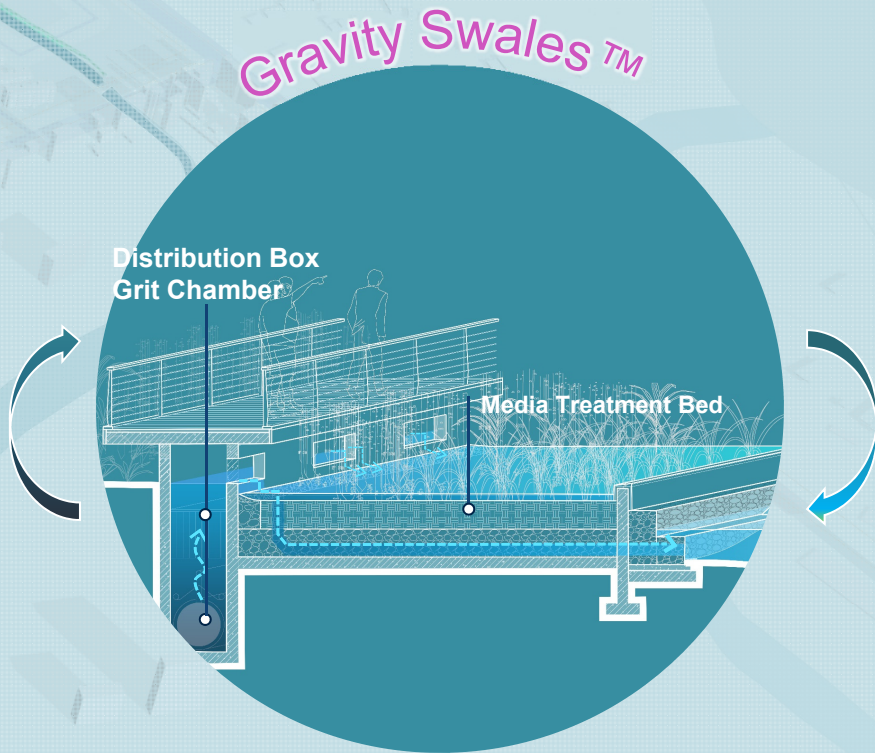
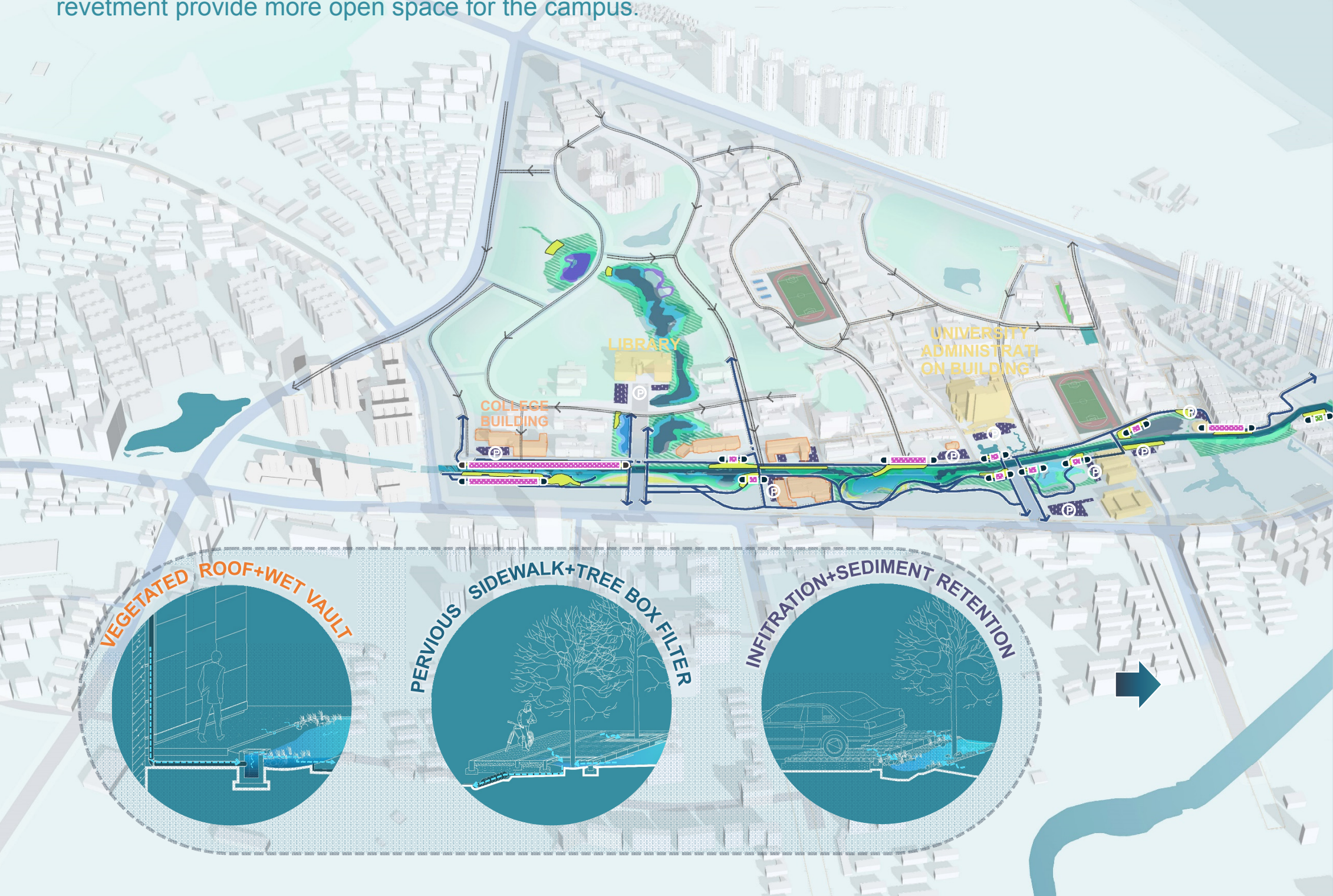
SPONGE TRANSFORMATION

Main Strategies Use technologies such as source LID, multi-stage biological filters, and high-load Gravity Swales™ to collect and purify rainwater. Expand the river channel and renovate the revetment provide more open space for the campus.

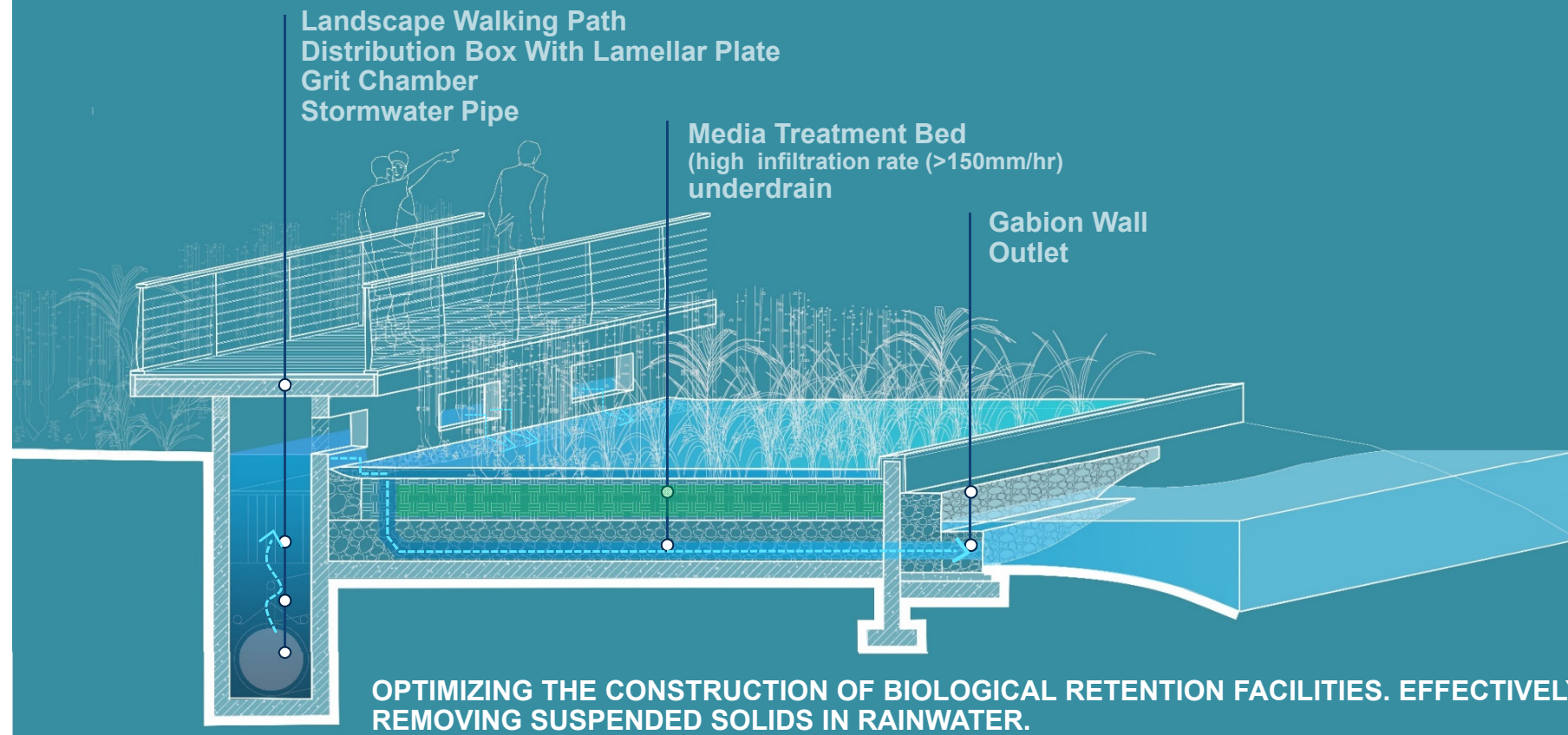
35000 m³/d

Rainwater purification capacity

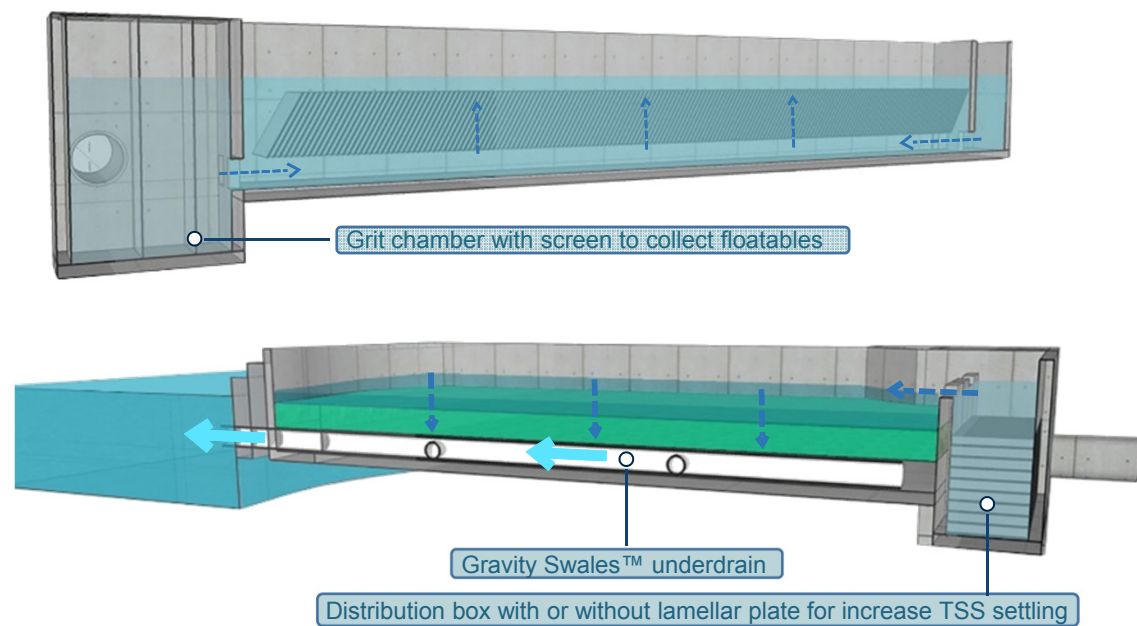
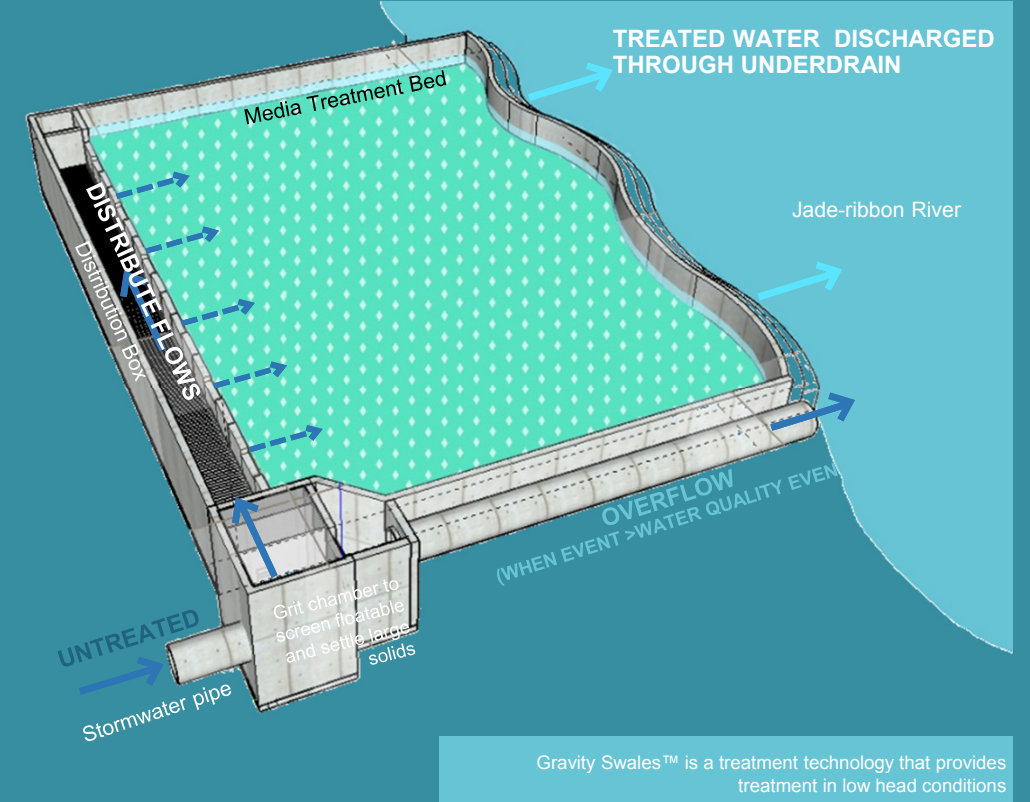
-  12 High Load Gravity Swales™
-  3.6 km Pervious Sidewalk
-  18000 m² Ecological Parking Lot



DETAILED CONSTRUCTION



Gravity Swales™ Flow Diagram



- Innovative use of inclined plate sedimentation tanks for rainwater in rainwater.
- Effectively remove about 80% of suspended solids and COD content.
- The processing capacity is 35000 m³/d, and the hydraulic load can reach 5-10m³/(m²d). Optimizing facility structure, low hydraulic conditions, and optimized wetland media can achieve efficient removal of pollutants to achieve the goal of purifying water quality
- Treatment media is engineered for high infiltration rate (>150mm/hr)
- TSS pollutant indicator removal rate 95%

RESULTS ACHIEVED

BIOSWALE

VIBRANT CAMPUS SPACE

RIPARIAN BUFFER

GRAVITY SWALE

Original River Range



RESULTS ACHIEVED

BIOSWALE

VIBRANT CAMPUS SPACE

RIPARIAN BUFFER

GRAVITY SWALE

Original River Range



RESULTS ACHIEVED

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RESULTS ACHIEVED

BIOSWALE

VIBRANT CAMPUS SPACE

RIPARIAN BUFFER

GRAVITY SWALE

Original River Range

RESULTS ACHIEVED

MUNICIPAL
STORMWATER PIPES

INCLINED PLATE
FILTRATION

MEDIA TREATMENT BED

FILTER STRIP



TSS pollutant indicator removal rate 95%
SURFACE CLASS IV WATER
(NH₃ -N 1.8mg/L, PO₄-P0.28 mg/L, BOD₅ 6 mg/L)

DESTROYED ORIGINAL
ARTIFICIAL REVETMENT

WIDENING THE SHORELINE

THE HEAVY RARELY SEEN
IN 30 YEARS



RIPARIAN BUFFER

RESULTS ACHIEVED



Landscape walking path
Distribution box with lamellar plate
Stormwater pipe

Media Treatment Bed
Gravity Swales™ underdrain

ORIGINAL HARD
RETAINING WALL



THE HEAVY RARELY SEEN IN 30 YEARS



GRAVITY SWALE



THE HIGH-LOAD GRAVITY SWALES™ IS A TECHNOLOGY THAT PROVIDES TREATMENT IN LOW HYDRAULIC GRADIENT CONDITIONS,CAN BE INTEGRATED IN TO THE LANDSCAPE AND BECOME A PARK FEATURE AND URBAN HABITAT.

RESULTS ACHIEVED



FILTER STRIP



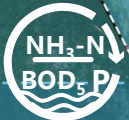
RIPARIAN BUFFER



FILTER STRIP

THE HEAVY RARELY SEEN IN 30 YEARS

TSS pollutant indicator removal rate 95%
SURFACE CLASS IV WATER quality
(NH₃-N 1.8mg/L, PO₄-P 0.28 mg/L, BOD₅ 8 mg/L)



THE GRAVITY SWALES™ INFRASTRUCTURE CAN BE COVERED BY WALKWAY AND INTEGRATED INTO THE LANDSCAPE TO LOOK LIKE NATURAL ELEMENTS.

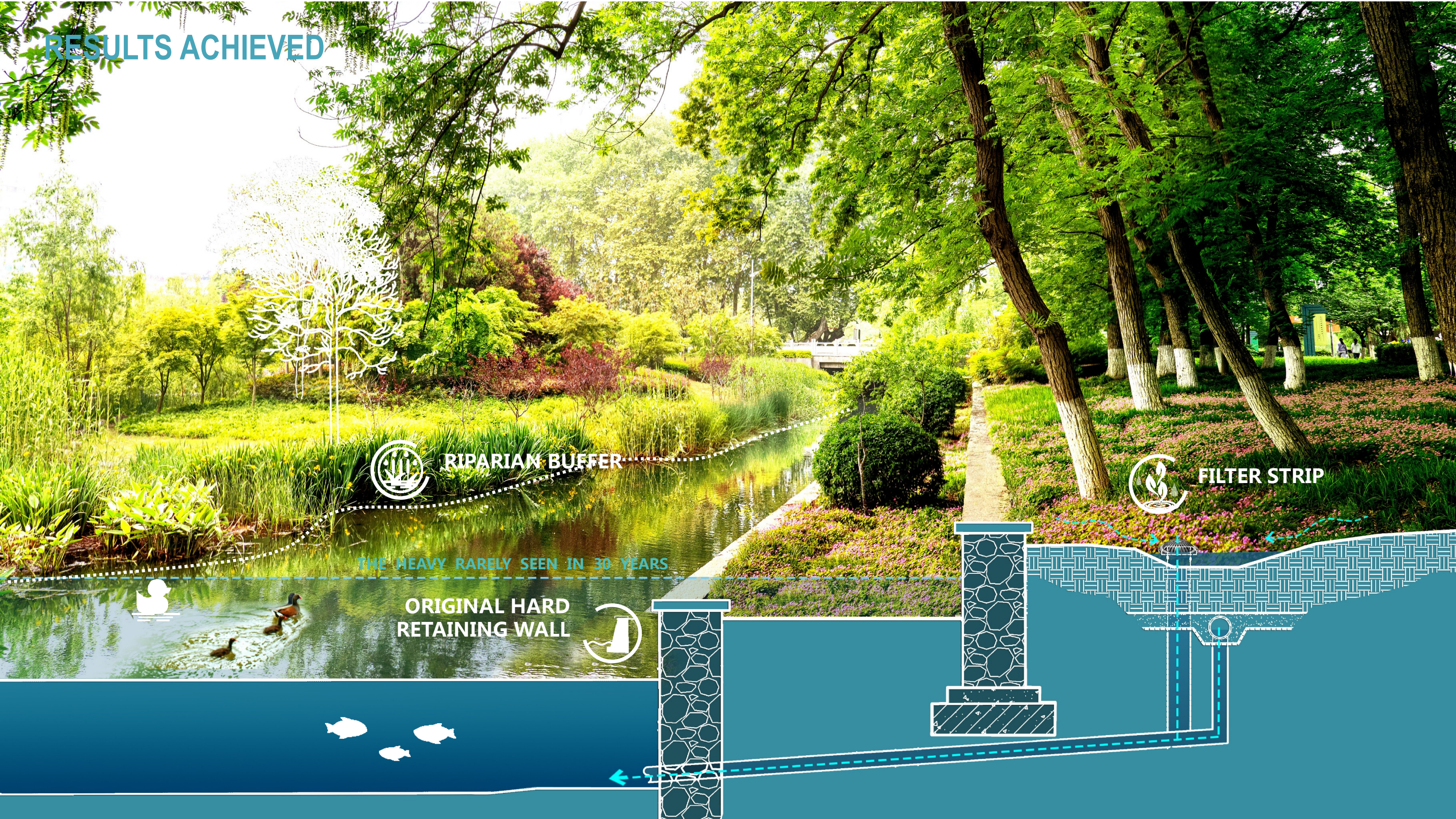
GRAVITY SWALE



MUNICIPAL STORMWATER PIPES



RESULTS ACHIEVED



RIPARIAN BUFFER



FILTER STRIP

THE HEAVY RARELY SEEN IN 30 YEARS

ORIGINAL HARD
RETAINING WALL



RESULTS ACHIEVED

THE HEAVY RARELY SEEN IN 30 YEARS

EXPANDED WATERFRONT WALKWAY



ORIGINAL HARD
RETAINING WALL

RESULTS ACHIEVED

THE BEAUTIFUL LANDSCAPE BRING MORE OPPORTUNITIES FOR THE DEVELOPMENT OF THE CONSTRUCTION AREA AND THE SURROUNDING URBAN AREAS, AND HAVE IMPORTANT SOCIAL, CULTURAL AND ECONOMIC SIGNIFICANCE.

RESULTS ACHIEVED

