Full-Cycle Water-Sensitive Design:

Rose Scientific Research and Industrial Park in Nanyang, China

PROJECT STATEMENT

Nanyang has a long history of rose cultivation and is a major rose production area in China. In recent years, the rose industry has shifted from traditional nurseries to high-end research and development, leading to the establishment of the Rose Scientific Research and Industrial Park. With a planned area of 12.8 hectares, the goal of this design project is to create a high-end research and development area for the Nanyang rose industry, integrating scientific research, nurseries, residential areas, exhibitions, hotels, and other comprehensive services. However, due to climate change, Nanyang, located in the transition zone between northern and southern China, has experienced frequent extreme weather and water-related disasters. The site has significant runoff and limited drainage, posing a high risk of flooding. Thus, the core issue in this design project is how to create a park that balances flood safety, reasonable water use, and livability.

The design team adopted a water-sensitive design concept, utilizing the SWMM model and a multi-objective optimization algorithm to establish a full-cycle design and management system based on water supply and demand analysis, multi-objective optimization of LID system, and intelligent management of rainwater resource utilization. Spatially, the design coordinated the layout of scientific research, residential, and integrated service functions to achieve landscape coupling of LID practices with the main buildings. Additionally, it balanced the spatial needs of stormwater management and rose cultivation, creating diverse plant habitats and rose-themed landscapes. The combination of water-sensitive design, building layout, and plant design ultimately allowed the park to effectively balance multiple goals of safety resilience, industrial efficiency, and environmental livability.

PROJECT NARRATIVE AND CONTENTS

01 BACKGROUND

In the context of upgrading the urban rose industry, the Rose Scientific Research and Industrial Park was planned in Nanyang's Wancheng District, adjacent to Nanyang Railway Station, with the World Rose Expo site to the south and Nanyang Jiangying Airport to the southwest, offering significant transport advantages. The surrounding area is primarily farmland, with the Bai River city channel to the west. The terrain is relatively flat, but urban road infrastructure around the site is still under construction, and the ditch and culvert systems are incomplete, posing significant drainage challenges for the future. Thus, while the site has geographical advantages and development opportunities for the rose industry, it also faces substantial flood risks.

Regional Water and Drought Temporal-Spatial Variability: Nanyang, located in Henan Province, is in the climate transition zone between northern and southern China, with a strong influence from the monsoon climate. The distribution of rainfall in time and space is highly uneven, with significant inter-annual variations, and annual rainfall fluctuations reaching 112%. Additionally, the complex terrain of Henan Province, with the Taihang and Funiu Mountains, creates uplift and convergence effects on airflow, easily forming areas of heavy rainfall. In recent years, global climate change has led to frequent extreme weather, resulting in multiple severe water-related disasters.

Rose Industry Upgrade Iteration: Nanyang is known as the "City of Roses" in China, with a rose cultivation area of 155,000 acres and an annual output of 1.6 billion rose seedlings. These seedlings are exported to over 20 countries and regions, including Germany, the Netherlands, and Japan, accounting for 70% of China's exports. However, the traditional rose industry mainly focuses on conventional seedling cultivation, with the development of new rose varieties and information management still in their early stages. The city urgently needs to build a high-end industrial park led by the rose industry to provide new growth points for the rose industry development.

PROJECT NARRATIVE AND CONTENTS

02 STRATEGY:

To address regional and surrounding flood risks and drainage pressures, and based on the functional needs of upgrading the rose industry, the design plan focuses on full-cycle water-sensitive design, integrating industrial functions and landscape recreation systems to achieve the three major goals of safety resilience, industrial efficiency, and environmental livability. The design integrates industrial functions, landscape functions, and flood management systems, which operate synergistically to create a beautiful, efficient, safe, and convenient rose scientific research and industrial park. The main strategies include:

Water sensitive design： The plan explores the construction of a quantitative design management approach based on low-impact development (LID) concepts. Through the NSGA-II algorithm and the SWMM model, the plan develops a cost-effective design scheme that mitigates flood risks for an area with variable drought and flood conditions. It successfully achieves the goal of utilizing all small to medium rainfall and reducing risks during heavy and extreme rainfall events.

-Developing Smart Water Resource Management System Based on Supply-Demand Relationships: The project categorizes and recycles rainwater on-site by combining storage and utilization facilities. By calculating the total rainfall runoff over five years, the runoff of different water qualities, the water resource demand of different water qualities, and the target runoff control volume, the appropriate scale of storage and utilization facilities is set to reduce facility vacancy rates and improve efficiency. Recycled and utilized rainwater reduces daily operation and management costs, transforming water hazards into water resources.In terms of management, the project connects storage and utilization facilities with water use units to create an intelligent water resource management system utilizing weather stations, monitoring equipment, sensors, smart irrigation devices, and a WIFI system.

-Water-Sensitive Design: Designing a Low Flood-Risk Safety System through Multi-Objective Optimization: After multi-objective optimization, the optimal LID scheme efficiently reduces the flood risk in the three industrial functional zones. For a storm scenario with a return period of 20 years, the peak runoff is cut by over 70%. In a 10-year return period storm, peak runoff is lowered by 74%. During a 5-year return period storm, the peak runoff is decreased by 79.93%. Remarkably, in a 1-year return period storm, the peak flow is completely eliminated, achieving a 100% reduction.

PROJECT NARRATIVE AND CONTENTS

02 STRATEGY:

Industrial function system: The park's functional layout is divided into three areas: integrated service, scientific research work, and residential living. Based on the spatial characteristics of each zone, the plan allocates flood facilities and landscape recreation elements accordingly. The integrated service area features public buildings and the main water body, the residential living area has scattered standalone residential buildings equipped with independent LID practices, and the scientific research work area integrates research buildings, greenhouses, and rose nurseries, organically connected with LID practices to ensure flood safety in the rose planting area. The northern and southern areas are divided by municipal roads, with the southern area being the scientific research work area, featuring centralized buildings, rose nurseries, and greenhouses to provide efficient office spaces for research work and optimized drainage facilities to ensure smooth drainage for rose nurseries. The northern area includes the residential living area and integrated service area. The integrated service area, along with the main detention pond, forms the park's main landscape area, featuring hotels, restaurants, gyms, and other service buildings. The residential living area consists of scattered standalone apartments arranged on both sides of the integrated service area. The standalone rainwater facilities in the residential living area are organically connected to the detention pond in the integrated service area through vegetative swales, achieving a spatial layout coupling service functions with flood management functions.

Landscape Recreation System: In terms of plant landscapes, the design skillfully integrates the unique charm of the rose industry, creating rose-themed landscapes such as rose nurseries, rose flower borders, and rose courtyards. These rose-themed plant landscape spaces are both industrial and display and recreational spaces. Additionally, incorporating vegetative swales, rain gardens, permeable cobblestone embankments, and green roofs, the park forms rich, natural plant habitats.

PROJECT NARRATIVE AND CONTENTS

03 BENEFITS:

The project innovatively constructs an integrated technological process for full-cycle rainwater risk control and smart water resource management, coordinating the diverse needs of industrial development, safety resilience, and comfort and convenience. Ultimately, it achieves three major benefits: hydrological ecology, economic efficiency, and industrial development. From the ecological aspect, the layout of rainwater facilities, rainwater storage culverts, and detention ponds achieves no external discharge of rainwater from the site and a 92% annual runoff control rate, controlling a total of 102,400 cubic meters of water. From the economic aspect, through the water cycle system and intelligent management system, the optimized combination of LID facilities saves 20.37% (1.2808 million RMB) in construction costs, reduces annual management costs by 11,360 RMB, and attracts numerous enterprises, driving the development of over ten new rose varieties in the city, creating significant economic value. Hotel room prices in the area have increased by an average of 120 RMB per room, boosting the development of the area's tertiary industry.

04 VISION:

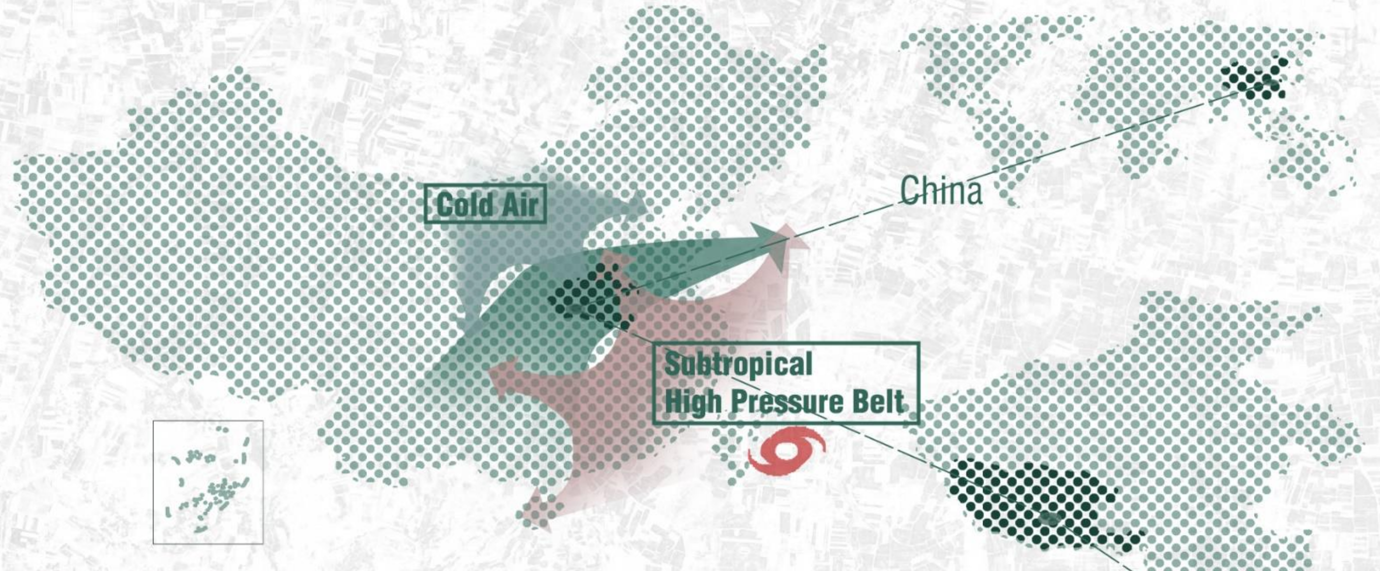
In the face of climate change challenges, the Rose Scientific Research and Industrial Park in Nanyang, with its forward-thinking design concept and innovative implementation strategies, has established a model project that integrates flood safety, water resource utilization, scientific research innovation, and human livability. Upon completion, the Rose Scientific Research and Industrial Park will become a new highland and gateway for China's rose industry, inheriting Nanyang's long history of rose cultivation and leading the rose industry towards a high-end, green, and sustainable development direction.

In the field of rose research, based on the modern management of rose nurseries and convenient service facilities, the park will become a cradle for the development of new rose varieties and technologies, attracting top global research talents.

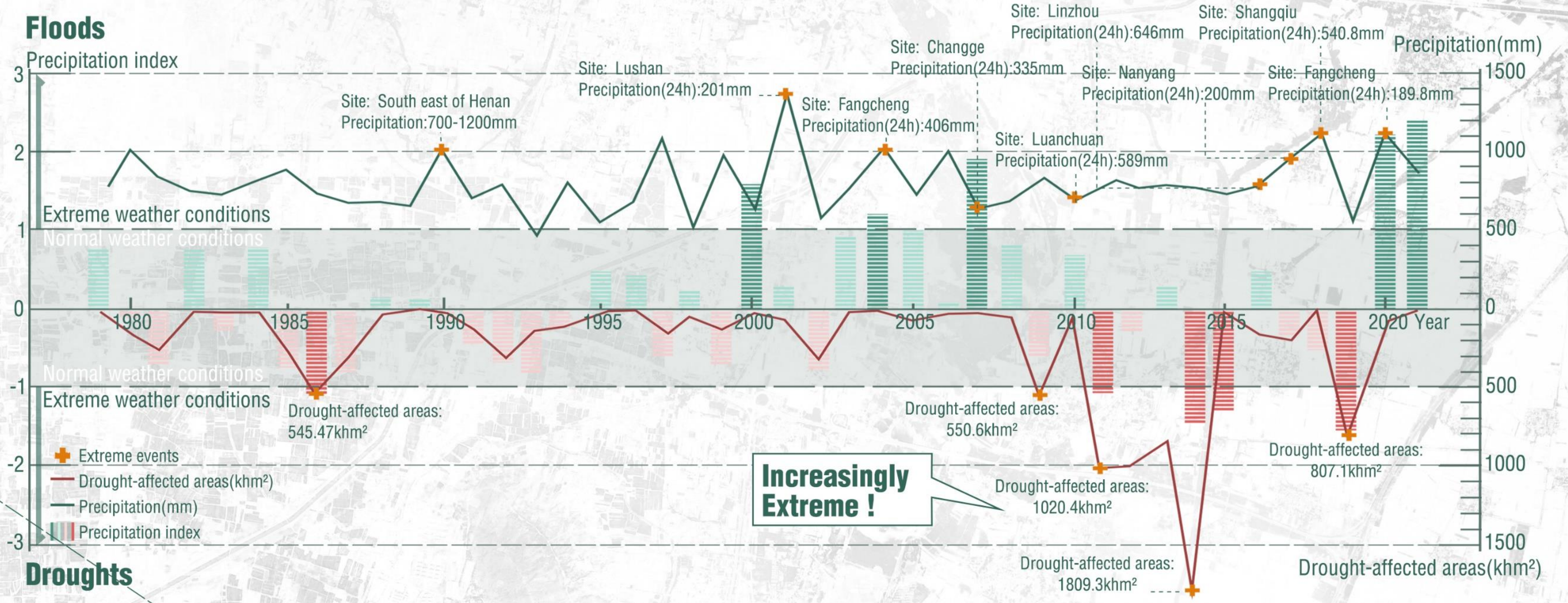
In terms of living services, the park, with its carefully designed flood management system and landscape, transforms flood risks into landscape resources, creating a harmonious and comfortable park environment.

BACKGROUND: Increasing Frequency of Extreme Weather Due to Climate Change

The Rose Scientific Research and Industrial Park is located in Nanyang, Henan Province, China. Nanyang City is situated in the transitional zone between northern and southern climates, with highly uneven temporal and spatial distribution of rainfall. Due to global climate change, extreme weather events have become increasingly frequent and unpredictable in recent years, leading to frequent floods and droughts, severely threatening residents' lives and economic development. The design site also faces severe challenges in flood safety.



The convergence of the subtropical high pressure from the south and the cold air from the north occurs in the central plains, while the mountains in the southwestern part of Henan exacerbate the accumulation of rainwater. These complex influencing factors result in seasonal and uneven rainfall distribution in the central plains, with frequent extreme weather and floods and droughts. There are severe challenges to the design site's flood management safety.



Heavy rainfall and floods occur annually, affecting a cumulative area of **33,599,400** hectares

Droughts occur every 2-3 years, affecting a cumulative area of **37,239,600** hectares

Frequent Droughts and Floods Due to Extreme Weather

• Fangcheng, Flood, July 2004
More than 140 villages were affected, with economic losses of 1.599 billion CNY.

• Linzhou, Flood, July 2016
Over 1.2 million people were affected, with 71.1 thousand hectares of crops damaged.

•Luanchuan, Flood, July 2010
About 1,494 houses collapsed, with economic losses of 1.98 billion CNY.

• Shangqiu, Flood, August 2018
Economic losses over 42,824 million CNY.

•Drought, July 2014
Over 739,000 people facing water drinking difficulties.

CHALLENGE: Balancing Design Needs of Flood Safety and Industrial Production

The Rose Scientific Research and Industrial Park should reflect the long-standing cultural history of roses in Nanyang city, and meet the functional needs of the transformation and development of the rose industry. At the same time, it also faces specific flood safety challenges due to difficulty of discharging site runoff. Scientifically addressing and resolving these issues is the key challenge of this design project.

Traditional Nurseries

Long History of Growing Chinses Rose

Research ⇒ **Production** ⇒ **Processing** ⇒ **Selling**

New Industrial Model

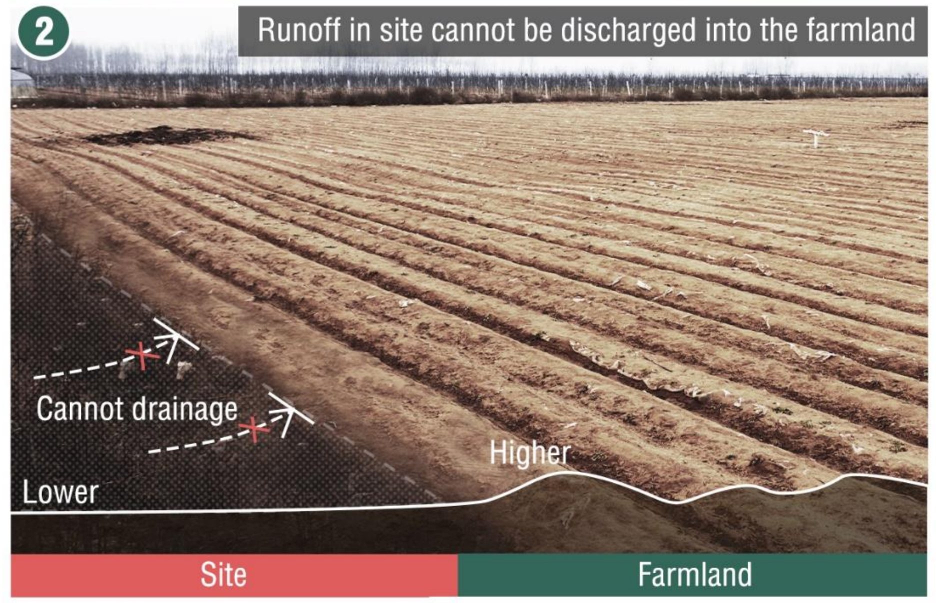
land value: **10,323 hectares** of land are being used to grow roses

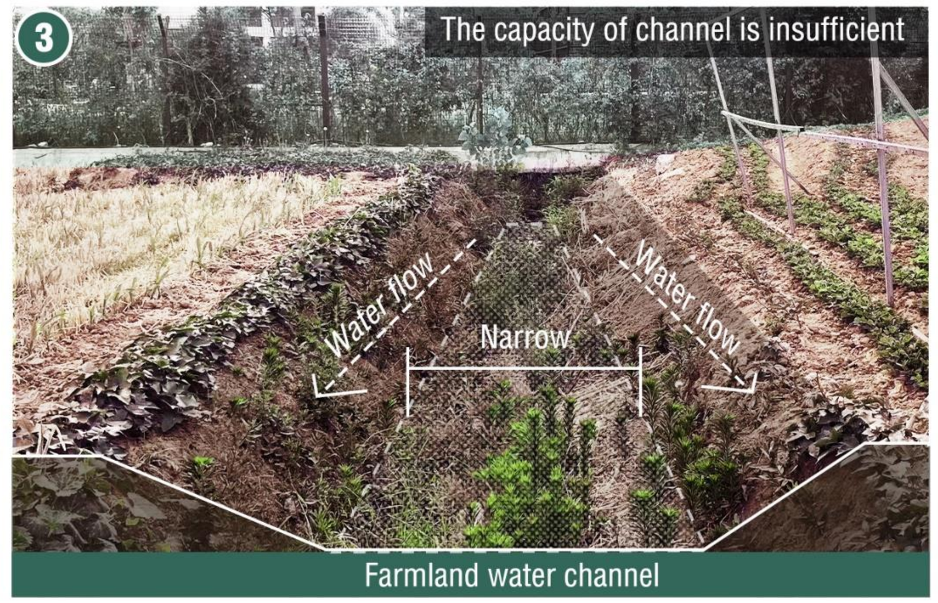
employment: **200,000 people** **2% of the population** engaged in rose industry and related work

economics: **2 billion CNY worth** of output is being produced annually

Urban Industrial Needs: Nanyang is an important historic rose production area in China. As a key industry in Nanyang City, the rose industry is undergoing a transformation from traditional nurseries to highly scientific industries. The design of this Rose Scientific Research and Industrial Park is dedicated to supporting and leading this transformation process.

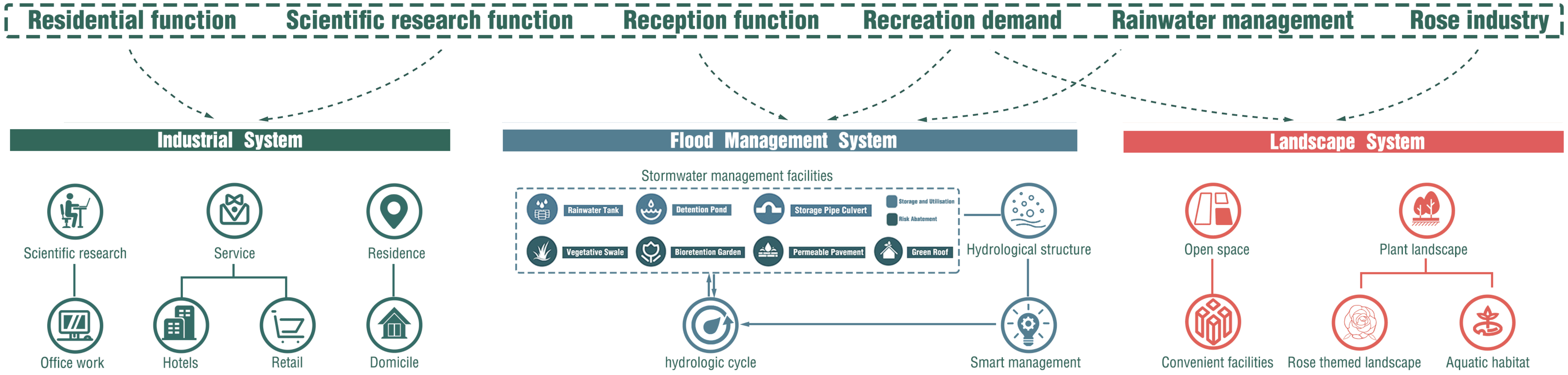
Flood Management Needs:
The design site is located below the dam, with an elevation lower than the river embankment and surrounding roads. Due to the lack of municipal pipelines, the runoff of the site can only be discharged through a channel in the farmland to the east, whose capacity is severely insufficient. During extreme rainfall events, the site faces significant inundation safety risks.

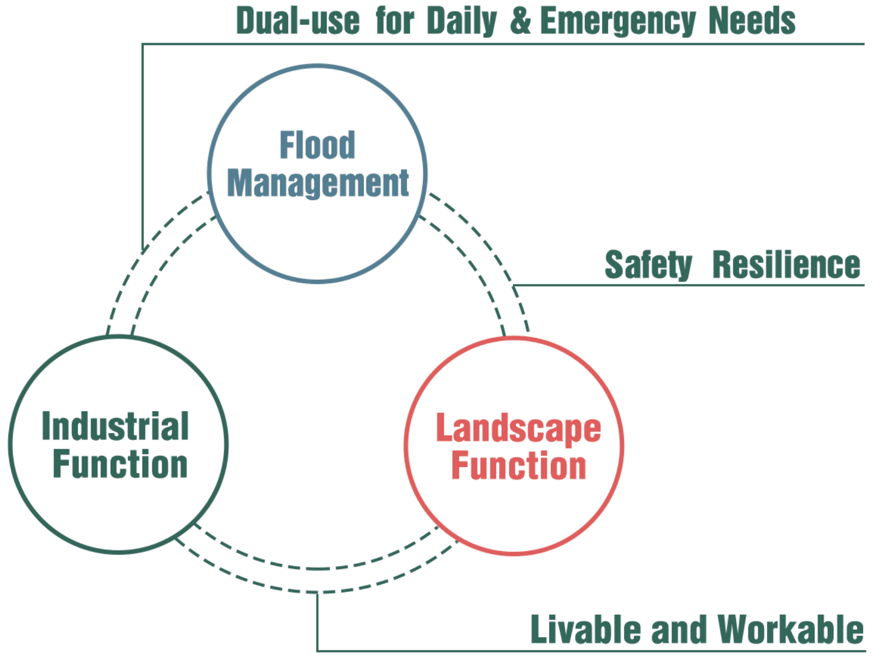




STRATEGIES & SITE PLAN

Based on the design requirements for upgrading the rose industry and addressing flood risk, this project is guided by a full-cycle water-sensitive design. It integrates industrial functionality and landscape recreation systems to achieve three main objectives: safety resilience, industrial efficiency, and environmental livability.

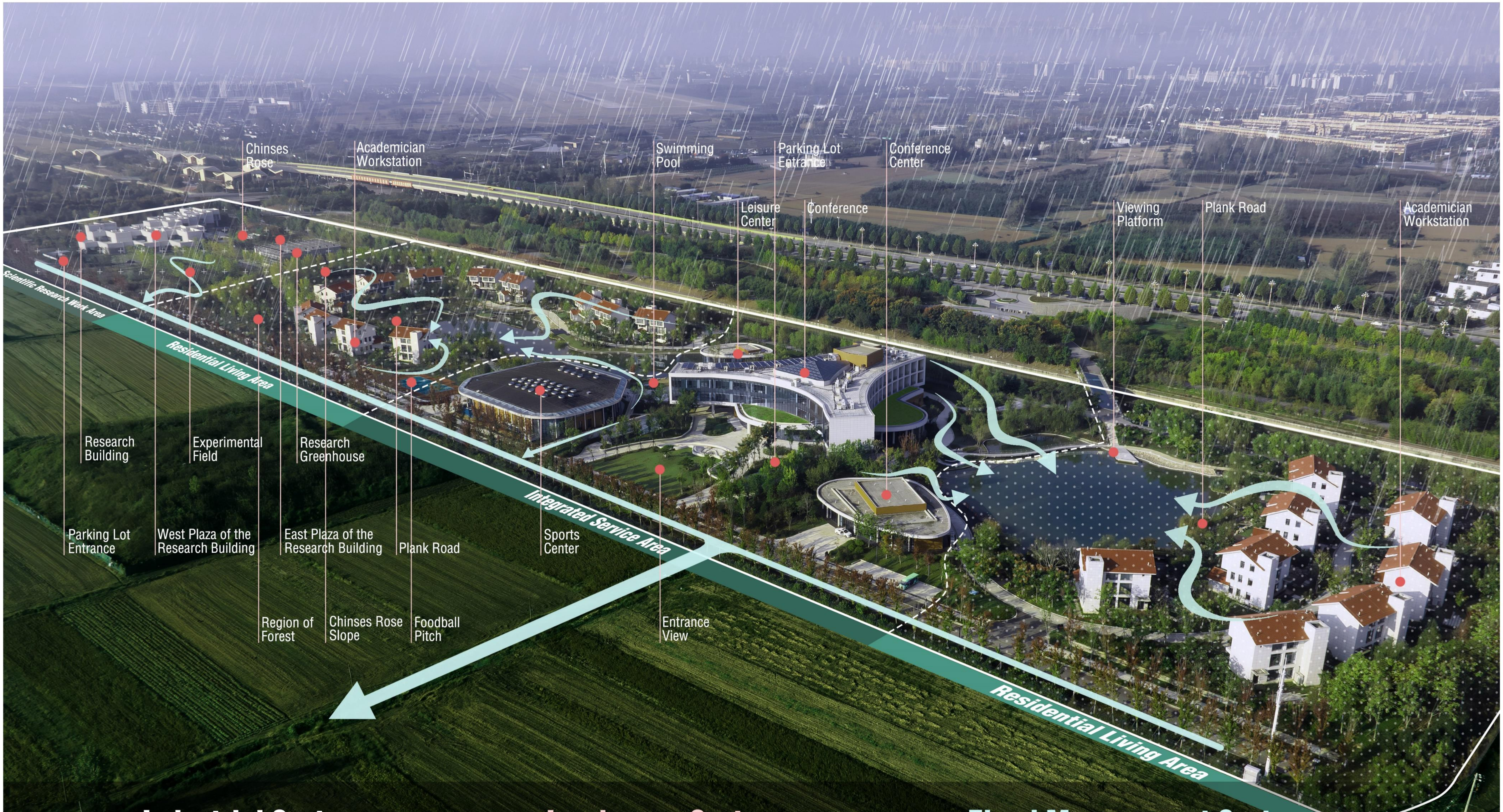




The park layout is divided into three functional areas: the Integrated Service Area, the Scientific Research Work Area, and the Residential Living Area. Each zone is designed with specific flood management practices and landscape recreation elements based on its spatial characteristics.

OVERALL LAYOUT: Integrating Industrial, Landscape and Flood Management System

Within the design site, the industrial function, landscape recreation, and flood management are integrated and work together in a coupled manner. This creates a decentralized layout with centralized management, resulting in an attractive, efficient, safe, and convenient reseach and industrial park.



Industrial System:

Three industrial functional zones: the Scientific Research Work Area, the Residential Living Area, and the Integrated Service Area.

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Landscape System:

The landscape system includes rose landscapes, rainwater landscapes, and various recreational facilities, all reasonably distributed throughout the park.

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Flood Management System:

The flood management system prioritizes the absorption of runoff at the source. Excess runoff is collected through low impact development (LID) practices and directed into a central detention pond. Any remaining overflow is discharged through the farmland water channel.

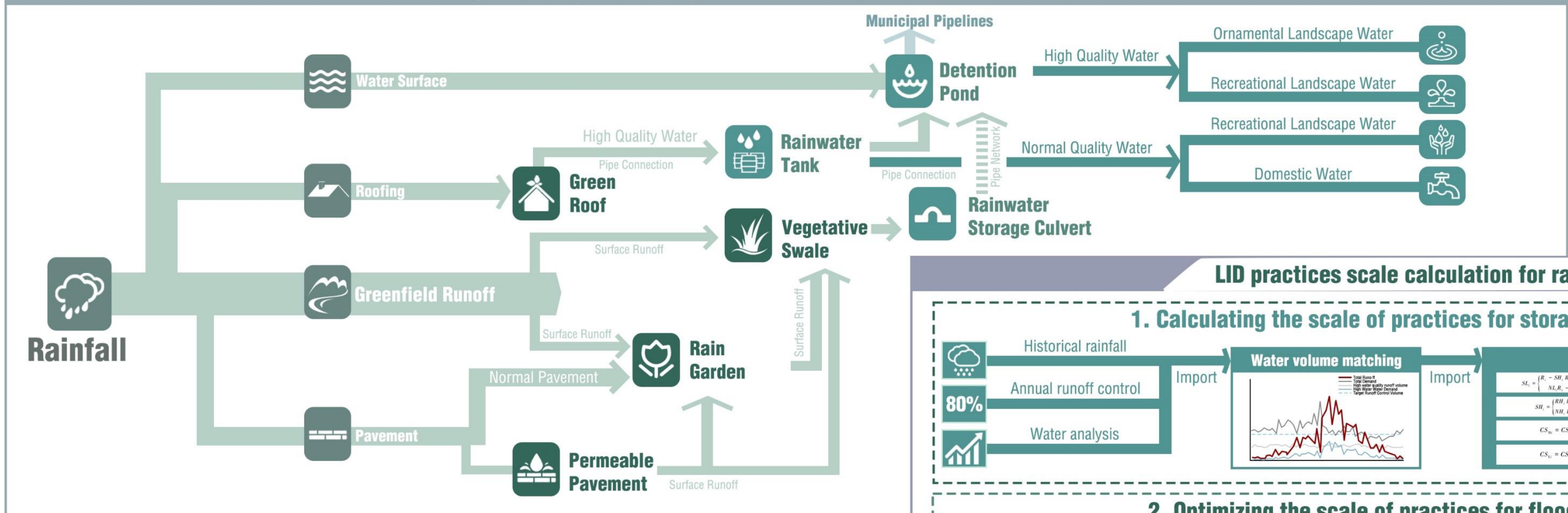
WATER-SENSITIVE DESIGN: Cost-effective & Low Flood Risk Park Shaped by LID

Integrating NSGA-II with SWMM, the project uses multi-objective optimization for efficient rainwater use and flood control.

Based on the concept of low impact development (LID), the project has developed a design scheme tailored to the region's highly variable climate, which is prone to both droughts and floods. This scheme successfully achieves the goals of **full utilization of rainwater during small to moderate rainfall events and risk reduction during heavy rainfall and storm events**.

The project **aligns the optimal scale of rainwater storage and utilization facilities with the supply-demand relationship** of rainfall and water usage during different periods.
Building on this foundation, **the NSGA-II algorithm and the SWMM model** are used to **maximize the flood mitigation effects and minimize the construction costs** through the optimal placement of LID practices.

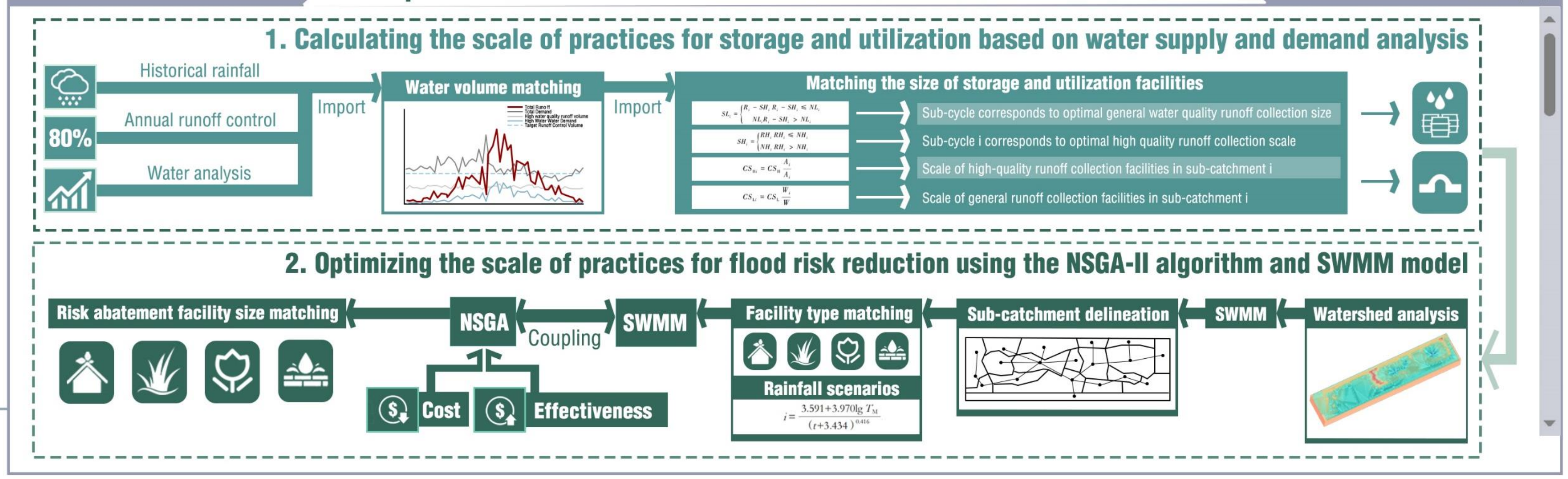
LID practice type matching for rainwater reuse and flood risk reduction



Considering multiple objectives, the rainwater runoff processes of the site are thorougly analyzed, 7 types of LID practices are selected for rainwater harvesting and flood risk mitigation.

Storage and Utilisation | Risk Abatement | Surface runoff processes

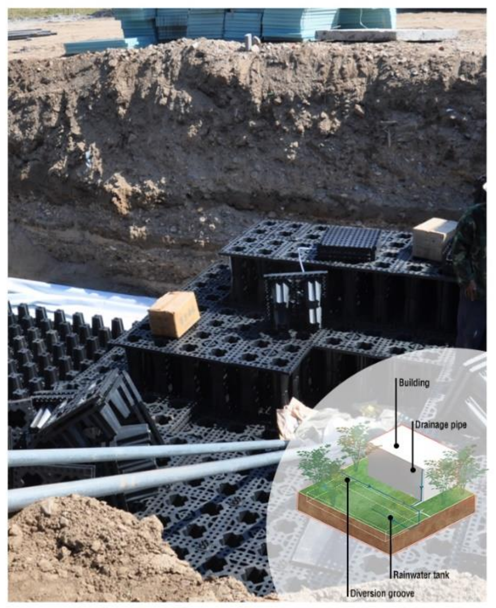
LID practices scale calculation for rainwater reuse and flood risk reduction



Apply 7 types of LID facilities to the site construction

7 types of LID facilities have been selected based on the storage and utilization of rainwater and infiltration and retention functions to complete the recycling of rainwater and reduce flooding.

Rainwater Tank

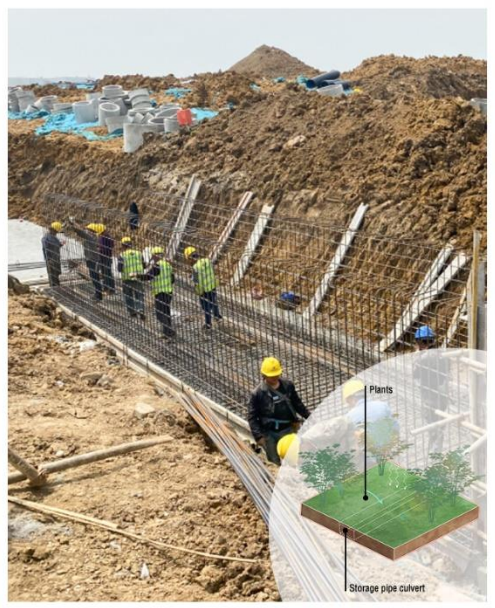


Rainwater tank is a container used to collect and store natural rainfall, usually for irrigation, washing, and other uses that help conserve water.

Detention Pond

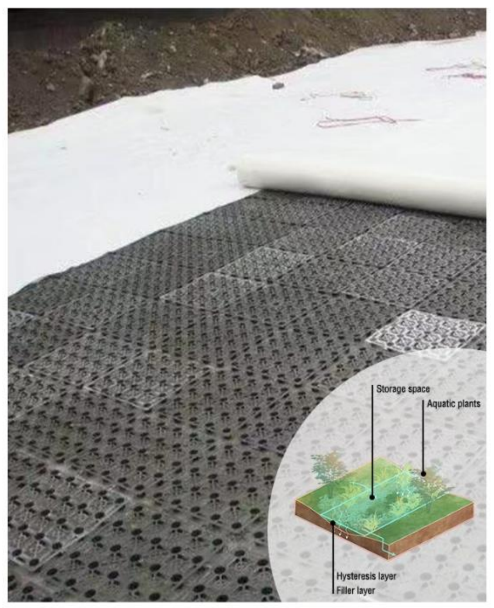
Detention pond balances water by temporarily storing and regulating the amount of water, improving the efficiency of the use of rainwater.

Rainwater Storage Culvert



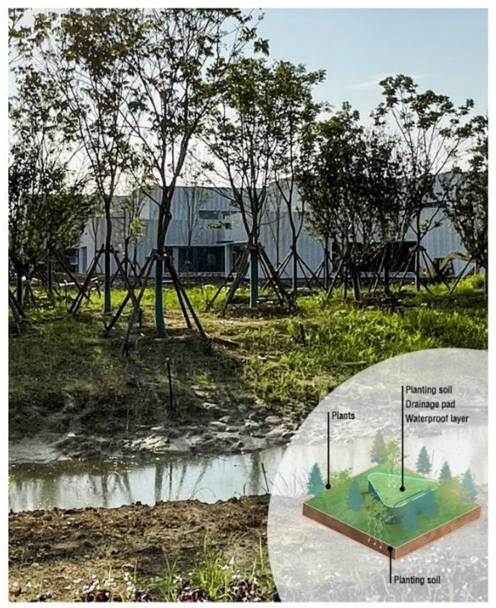
Rainwater storage culvert is mainly buried underground and is used to collect, store and convey surface water and groundwater.

Green Roof



Green roofs are rooftop detention facilities consisting of a special drainage bedding layer with soil and vegetation.

Vegetative Swale



Vegetative swales are low-lying areas covered with vegetation that slow down runoff and accelerate its infiltration into the soil.

Rain Garden

Rain garden allows direct rainfall and surface runoff to evaporate, infiltrate, and store some of the water.

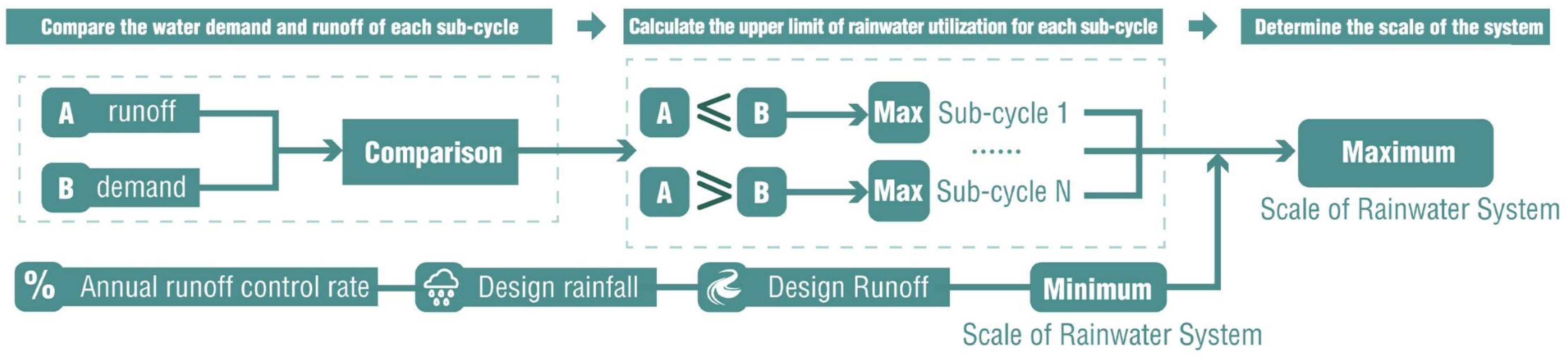
Permeable Pavement

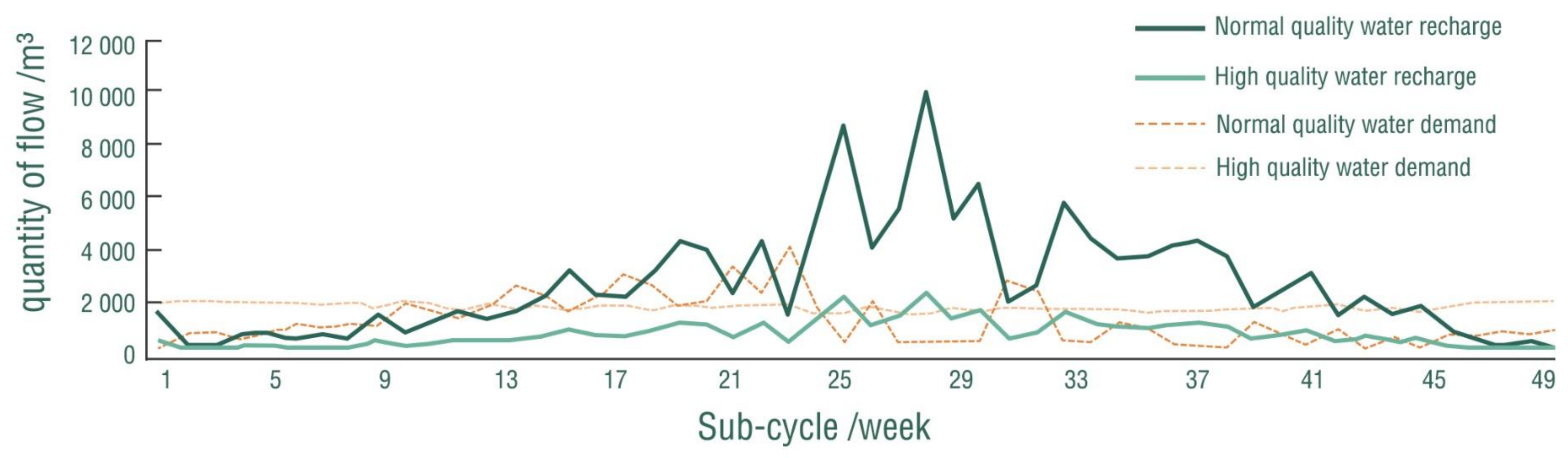
Penmeable Pavement allows precipitation to pass through the permeable material into the gravel storage layer and infiltrate into the soil.

WATER-SENSITIVE DESIGN: Developing Smart Water Resource Management System

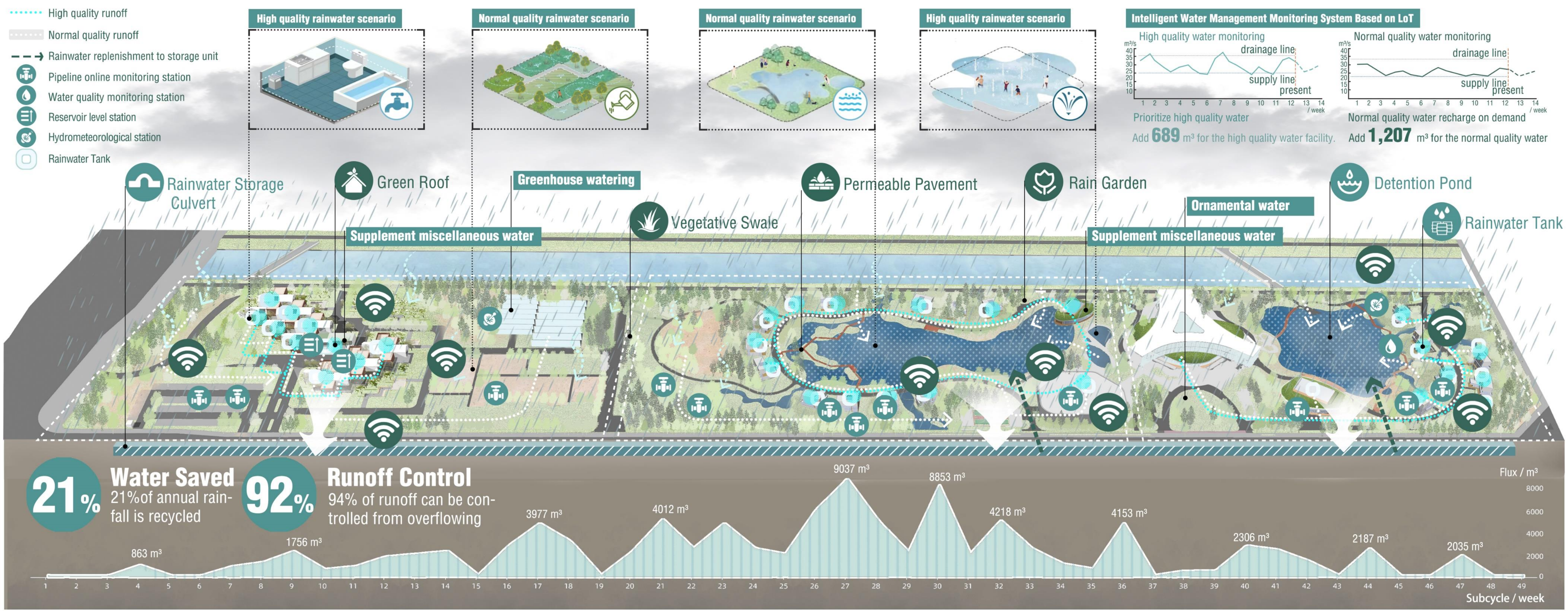
By matching the scale of storage and utilization facilities with the water supply and demand relationship, transforming water hazards into beneficial water resources

The project incorporates facilities for the classification and utilization of rainwater within the site. By calculating the total rainfall runoff, different water quality runoff volumes, water resource demand for various water qualities, and target runoff control volumes over the past five years, the project sets appropriate scales for storage and utilization facilities. This approach reduces facility vacancy rates and enhances efficiency. By reclaiming and utilizing rainwater resources, the project lowers daily operational management costs and transforms potential water hazards into beneficial water resources.





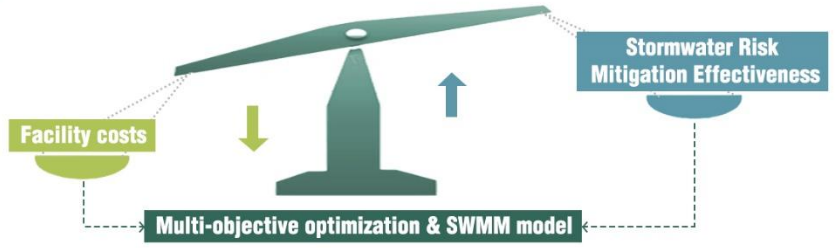
Manage Rainwater Resources in the Park by Combining Intelligent Water Management System and Storage and Utilisation Facilities (IWMS)



WATER-SENSITIVE DESIGN: Designing a Low Flood-Risk System by Multi-Objective Optimization

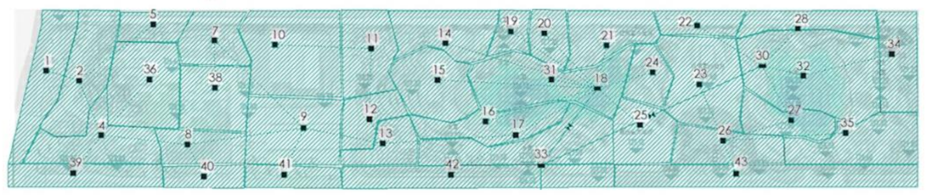
By calculating the optimal scale of LID practices using the NSGA-II algorithm, the project aims to mitigate flood risk

Coupling the multi-objective optimization algorithm and the SWMM model, the scale of LID practices is obtained for maximizing flood mitigation effects and minimizing investment costs.

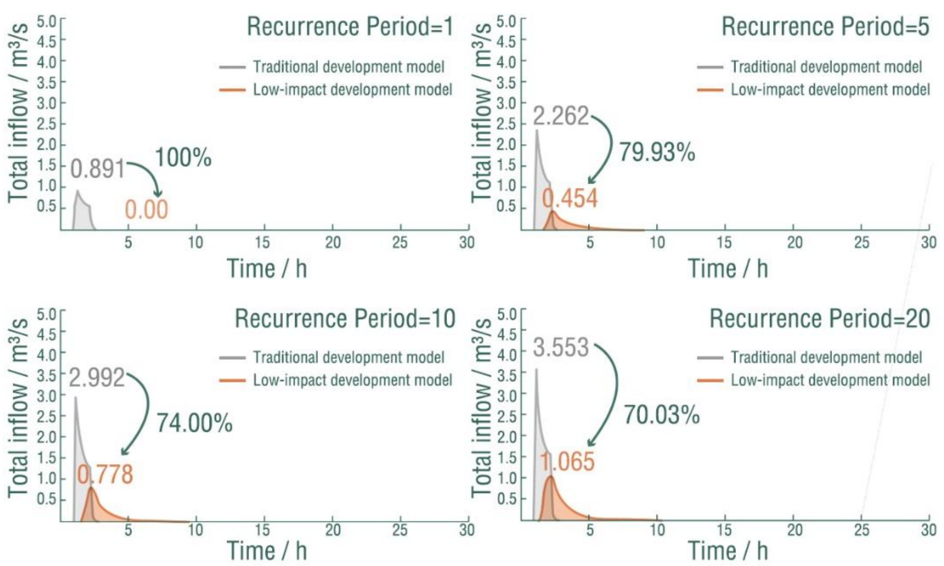


Balancing Facility Cost & Risk Abatement Effect.

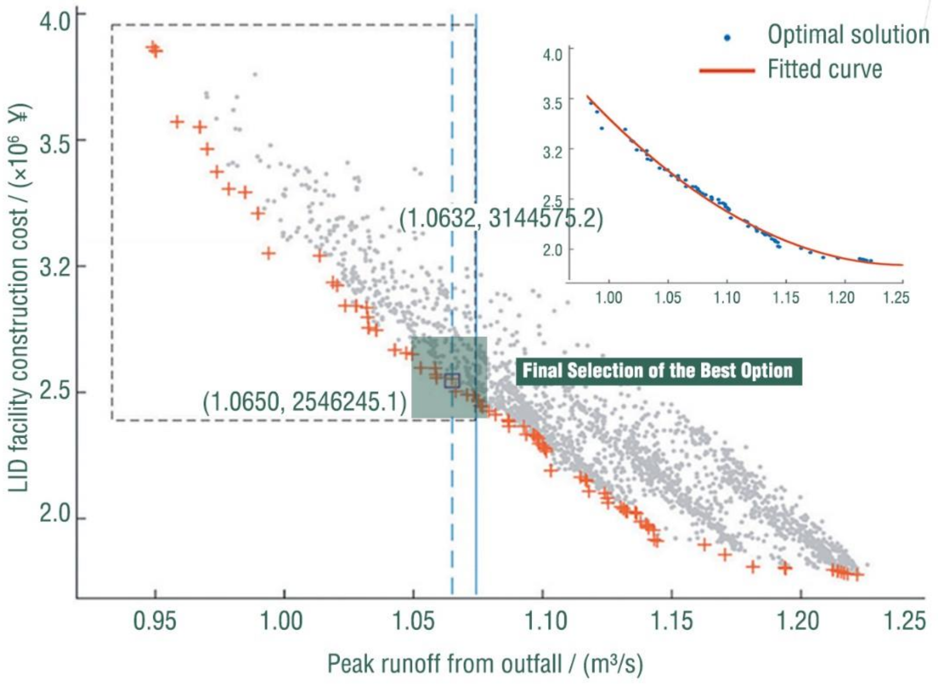
STEP1 Identify and delineate the sub-catchments



STEP2 Combine SWMM and NSGA-II for multi-objective optimization



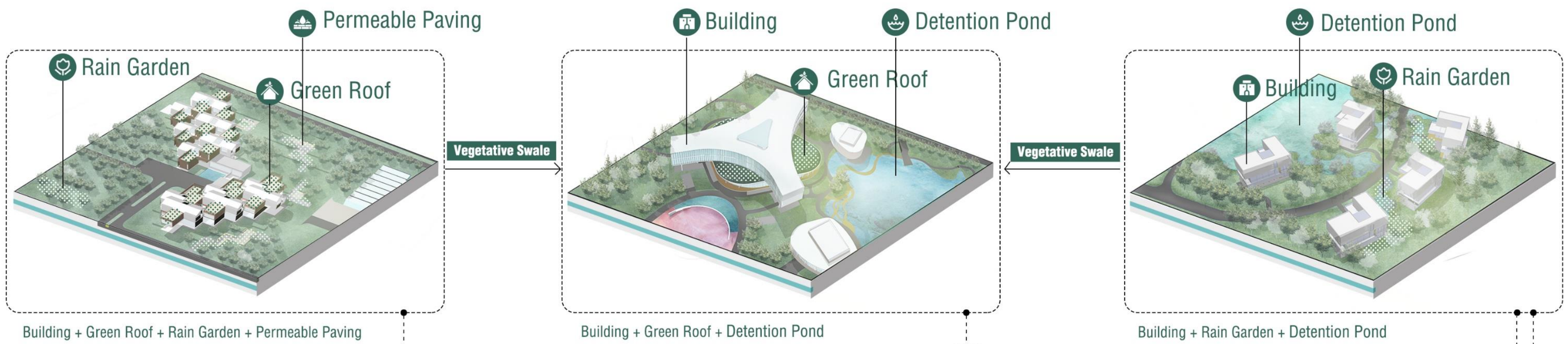
STEP3 Select the optimal solution among the Pareto solution set

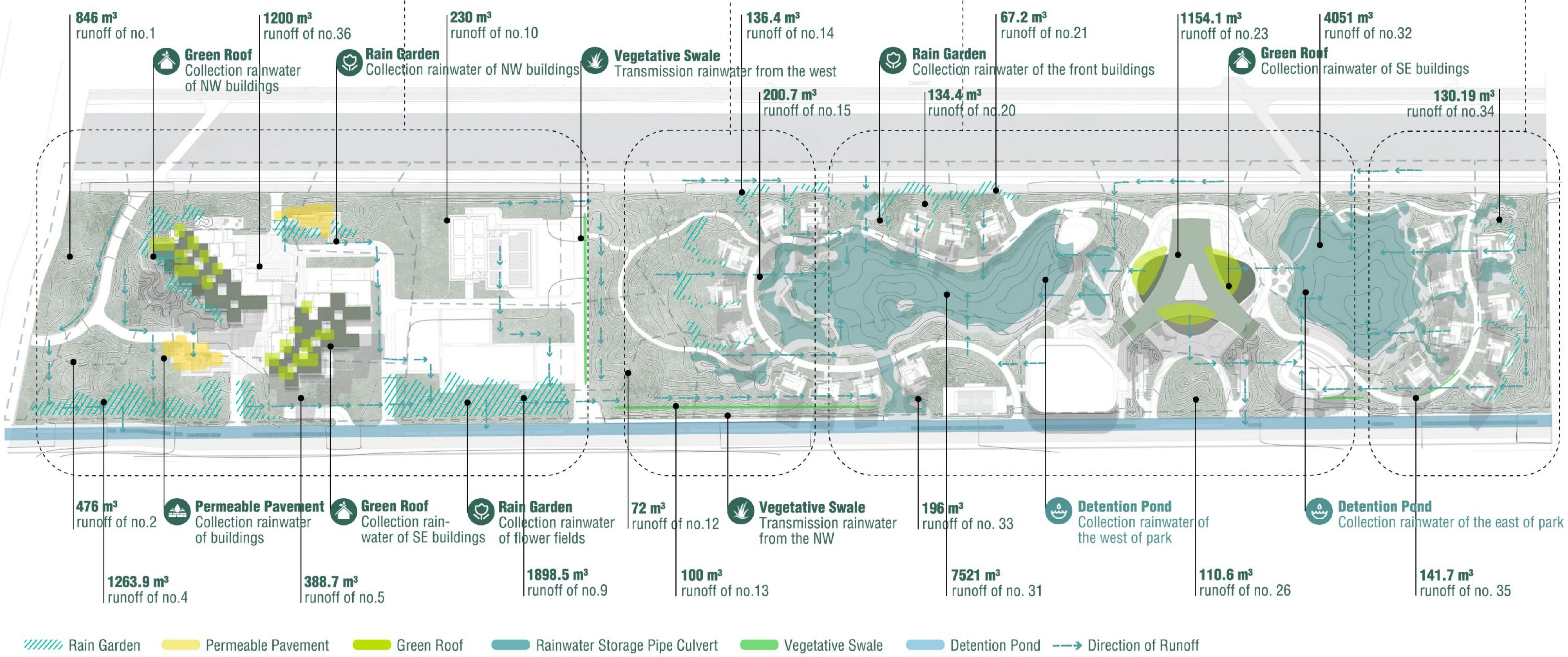


Final Solution: The LID scheme effectively mitigates flood risks in three industrial areas. It reduces peak runoff by **70.03%** for a 20-year storm, **74.00%** for a 10-year storm, and **79.93%** for a 5-year storm, and completely **100%** eliminating peak flow for a 1-year storm. The design prevents internal flooding in 20-, 10-, and 5-year storms and eliminates runoff in 1-year storms. The LID practices cost 5.0082 million RMB, a 20.37% (1.2808 million RMB) savings over the worst-case scenario.

70% **Risk Reduced** Reducing Stormwater Risks for Daily Rainfall Events.

20% **Cost Saved** More cost-effective than direct construction of facilities.





Based on terrain, buildings, and other conditions, strategically place LID practices for runoff reduction within each sub-catchment.

FLOOD MANAGEMENT SYSTEM:

Integrated Service Function Building Environment

The Integrated Service Area features large building areas with many activity spaces but limited green space. The LID practices primarily include Detention Ponds, Vegetative Swales, Green Roofs, and Rainwater Storage Pipe Culverts. The expansive lake surface not only offers excellent scenic views but also, combined with permeable cobblestone embankments, provides storage and infiltration space. The Vegetative Swales along the roadsides enhance the potential for rainwater infiltration within the limited green space, reasonably guiding runoff and creating an ecological roadside landscape.

Vegetated Swale

The vegetated swales in this area can effectively manage and direct the flow of stormwater, occupying an area of approximately 110.6m².

Detention Pond

Detention pond can store rain water permeably, effectively replenishing the groundwater. They cover an area of approximately 11572m².

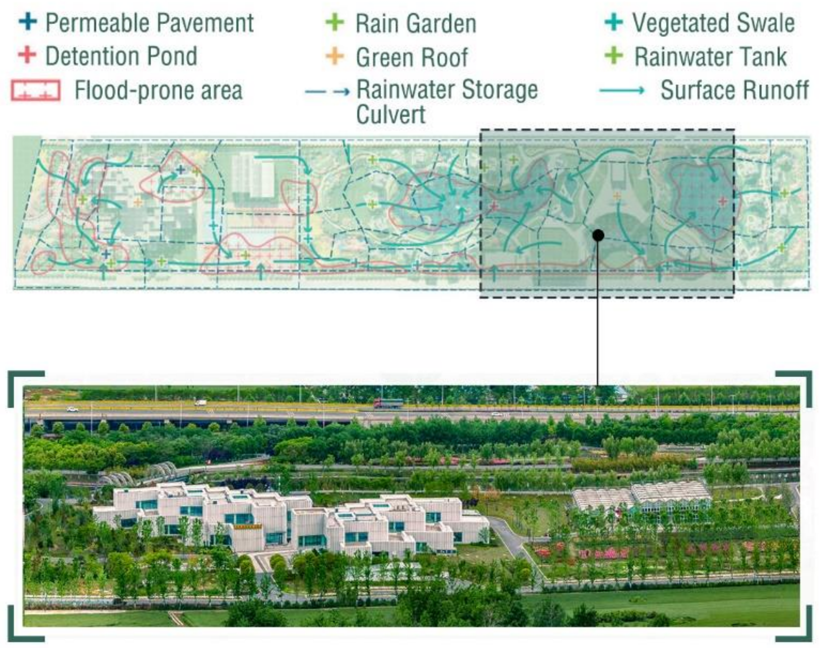
Green Roof

The central building's roof is a green roof, capable of absorbing and retaining rainwater. It covers an area of approximately 1183.12m².

Rainwater Storage Culvert

Direct site rainwater to the drainage system to effectively reduce the risk of flooding disasters.

Location of the Integrated Survice Area



FLOOD MANAGEMENT SYSTEM:

Scientific Research Work Function Building Environment

Rainwater collected from the green roofs is stored in rainwater tanks, while ground-level rainwater is directed through vegetative swales to the rain gardens for detention and infiltration. This rainwater management system reduces the flood risk for the research buildings.

Permeable Pavement

Permeable paving can enhance rainwater infiltration and reduce surface runoff. It covers an area of approximately 937.92m².

Rain Garden

The rain garden in this area is larger and can effectively detain and infiltrate rainwater. It covers an area of approximately 4132.55m².

Vegetated Swale

The vegetated swale are laid along the roads to guide runoff, covering an area of approximately 109m².

Green Roof

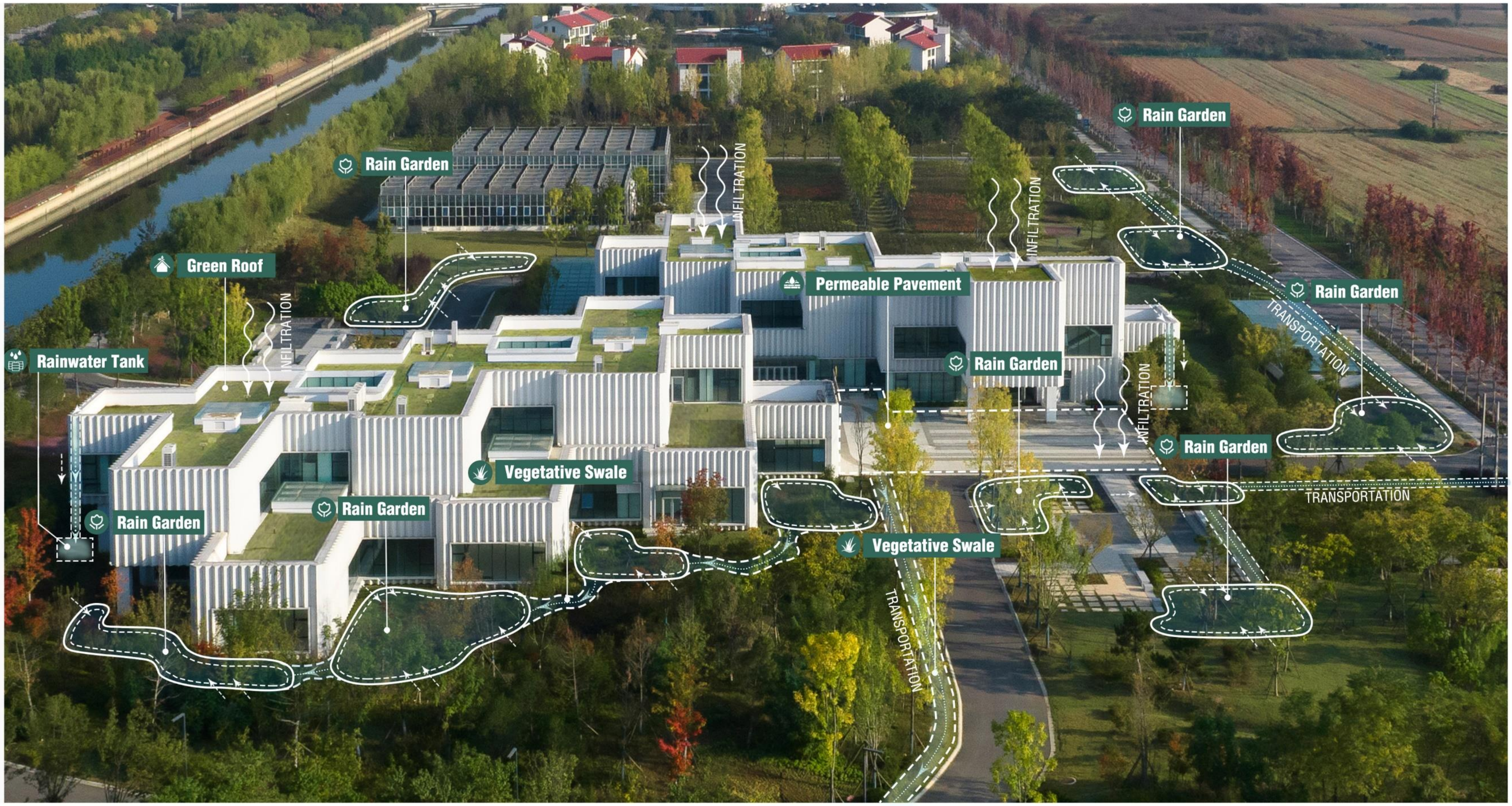
The office building features a 1200m² green roof that effectively buffers rainwater runoff, enhancing water management.

Rainwater Storage Culvert

Direct site rainwater to the drainage system to effectively reduce the risk of flooding disasters.

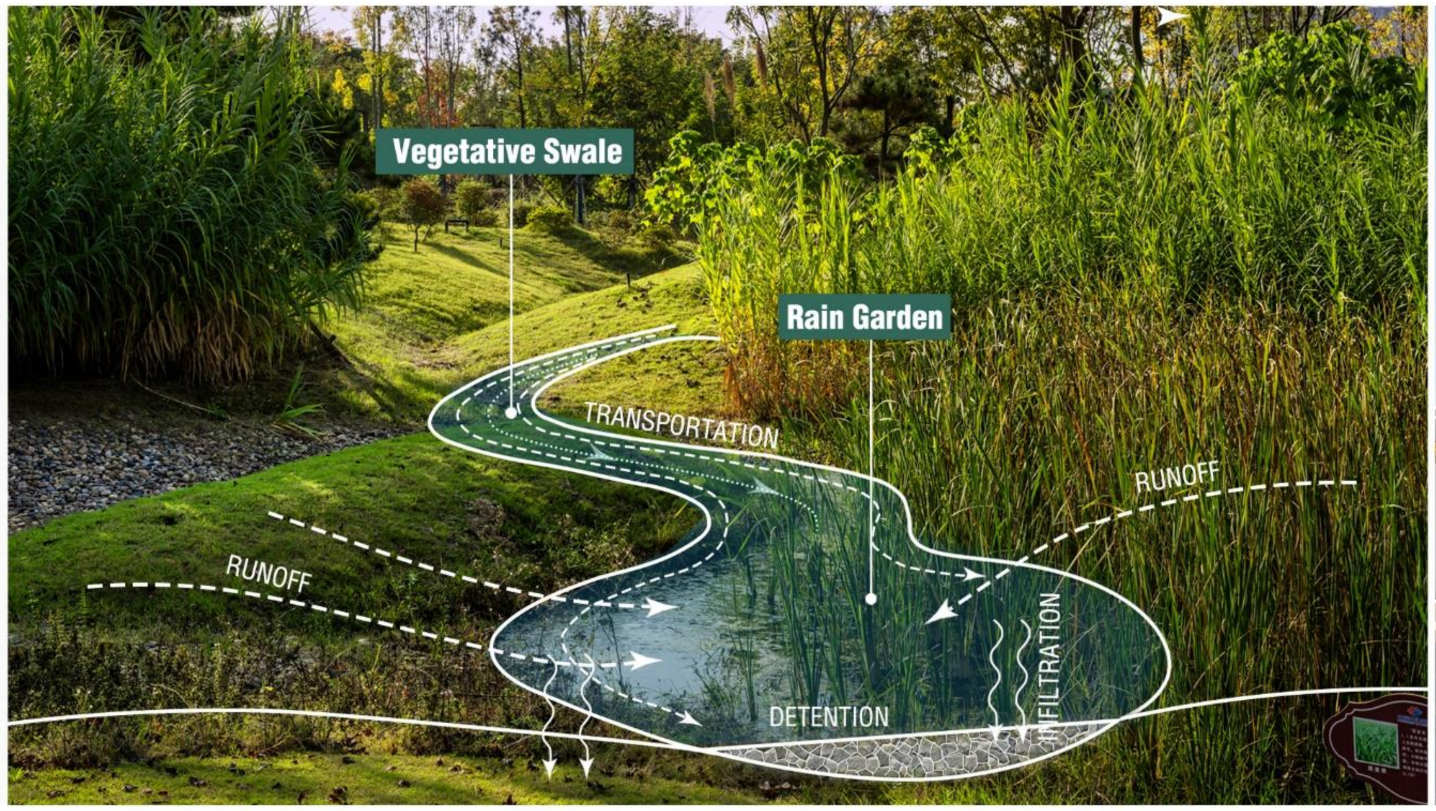
Rainwater tank

Collect and store rainwater to reduce overflow and ease drainage system stress.



Location of the Scientific Research Work Area

+ Permeable pavement
+ Rain Garden
+ Vegetated Swale
+ Detention Pond
+ Green Roof
+ Rainwater tank
Flood-prone area
Rainwater Storage Culvert
Surface runoff



FLOOD MANAGEMENT SYSTEM:
Residential Living Function Building Environment

The Residential Living Area consists of small, dispersed buildings. Small rain gardens are integrated into the courtyard designs and interconnected by vegetative swales to form a network, facilitating the collection, detention, and infiltration of rainwater. Excess water overflows into the landscape lake. These aesthetically pleasing LID practices ensure rainwater safety for the residential buildings while creating a rich and enchanting water landscape within the residential space, featuring rain gardens, rock waterfalls, cascades, streams, and islands.

Rain Garden

The rain garden is relatively small but can still permate and retain rainwater to a certain extent. It covers an area of approximately 1546.8m².

Vegetated Swale

Vegetated swale effectively direct stormwater runoff,alleviating the site's drainage pressure.They cover an area of approximately 581.4m².

Rainwater Storage Culvert

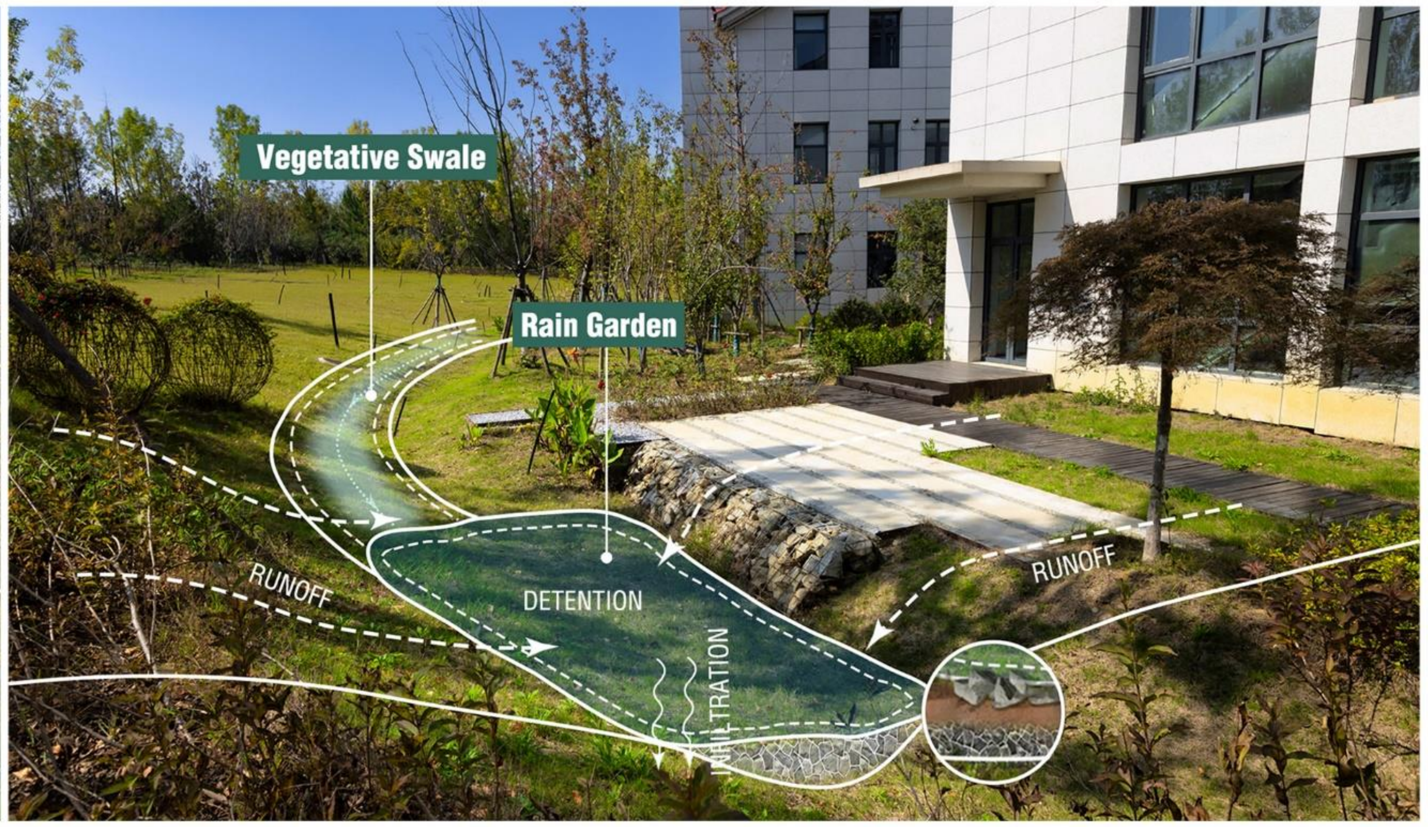
Direct site rainwater to the drainage system to effectively reduce the risk of flooding disasters.

Rainwater Tank

Collect and store rainwater to reduce overflow and ease drainage system stress.

Location of the Residential Living Area

+ Permeable pavement
+ Detention Pond
Flood-prone area
+ Rain Garden
+ Green Roof
Rainwater Storage Culvert
+ Vegetated Swale
+ Rainwater tank
Surface runoff



LANDSCAPE RECREATION SYSTEM: Chinese Rose-Themed Spaces

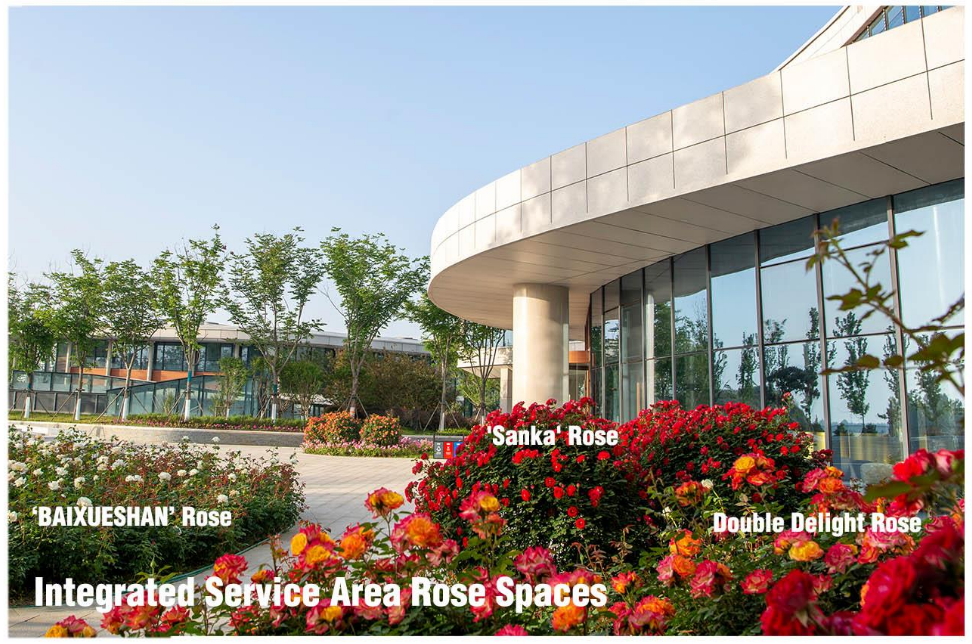
The primary function of the design site is for scientific research and industrial production of rose. Consequently, rose elements are extensively incorporated into the landscape design.In the Scientific Research Work Area, the rose nurseries serve as experimental grounds for researchers and create a spectacular sea of roses. The plazas and green spaces in the Integrated Service Area prominently feature various rose flowers. In the Residential Living Area, the design team has planted a distinctive rose variety from Nanyang in each building's courtyard and named the courtyards accordingly, promoting the unique roses of Nanyang. The gates, roadsides, and stream banks are adorned with rich rose landscapes.The entire park features a total of 28 rose varieties, with the rose planting area covering more than 40% of the site, achieving a dual benefit of rose industry promotion and rose landscape enhancement.

28 Species

40% Planting Area

Scientific Research Work Area Rose Spaces

Residential Living Area Rose Spaces



Integrated Service Area Rose Spaces

Chinese Rose Varieties Planted in the Garden:

Nanyang City, Henan Province is the famous hometown of Chinese Rose in China, with a profound Chinese Rose culture tradition. It has cultivated a variety of moon season varieties.

'Canary ' Rose | 'Sheila's Perfume' Rose | 'Pink Fan' Rose | 'Arctic Wind God' Rose | 'Yuzen' Rosa | 'Carefree Wonder' Rosa | 'DayDutchstars' Rosa | 'Porte Bonheur' Rosa | 'Lv Ye' Rosa | 'Golden Scepter' Rosa | 'Gold Medal' Rosa

'Sanka' Rose | 'Perfume Delight' Rose | 'BAIXUESHAN' Rose | 'Green Star' Rose | 'Pfalzer Gold' Rose | 'Pink Peace' Rose | 'Saiun' Rose | 'Fragrant Cloud' Rose | 'Yametsu-Hime' Rose | 'Blue Moon' Rose | 'Double Delight ' Rose

LANDSCAPE RECREATION SYSTEM: Diverse Plant Habitats

To achieve ecological balance and flood management within the landscape system, the design emphasizes the detailed design of aquatic plants and natural embankments, creating a rich habitat for aquatic vegetation. Priority is given to selecting aquatic plant species that are well adapted to the local climate and hydrological conditions. By strategically arranging these plants, the design forms a diverse plant community structure. Combined with flood management facilities, this approach enhances the stability and biodiversity of the ecosystem, ultimately creating a naturalized rainwater landscape.

35 **Aquatic Plant**
35 species of aquatic plants

6 **Types**
6 Types of Revetment

Meandering Lake Islands That Create Rich Plant Habitats

Residential Living Area

Rain Garden

LANDSCAPE RECREATION SYSTEM： Waterfront Recreational Facilities

The waterfront area is a crucial component of the site, providing visitors with opportunities for close interaction with water while serving as a key area for ecological balance and flood management. Through the design and layout of lake boardwalks and various types of embankments, the project safely integrates flood management facilities into the landscape, achieving a perfect blend of functionality and aesthetics.

LANDSCAPE RECREATION SYSTEM: A Livable and Workable Park

Low-Carbon Facilities Landscape

The design incorporates local construction materials, low-carbon permeable pavements, and high carbon-sequestration plants to reduce environmental impact while providing a natural experience.

Livable and Workable Parks

The landscape system of the park focuses on the design of recreational and lighting facilities to create a convenient and comfortable environment for both production and living. The recreational facilities are designed to meet the leisure needs of visitors, including diverse resting areas, seating installations, and walking paths. The lighting design enhances the night-time landscape effect of the park. These features enhance the functionality and aesthetics of the park, creating a convenient and comfortable environment for all users.

VALUE&BENEFITS

The project innovatively constructs an integrated technological process for full-cycle rainwater risk control and smart water resource management. This approach coordinates the diverse needs of industrial development, safety resilience, and comfort and convenience. Ultimately, it achieves three major benefits: hydrological ecology, economic efficiency, and industrial development.

Ecological Value


Water landscape


Rain Garden

Ecological Value

Control **102400m³** of water
0 runoff discharge


The total annual runoff control rate reaches 92%

Save management fee of ¥ 113600 per year

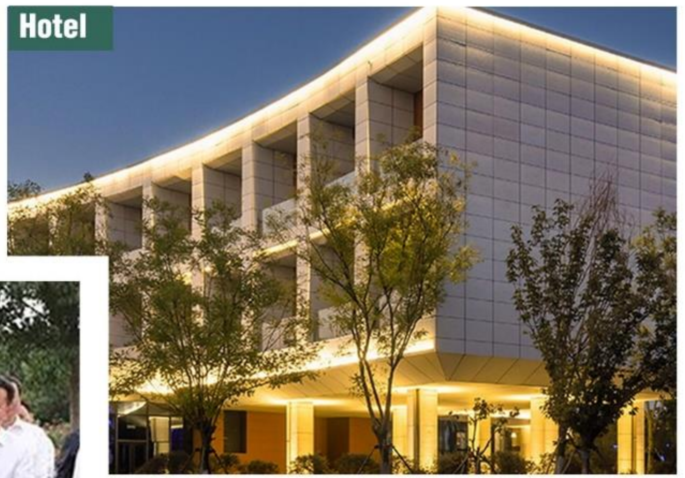

Nursery

Economic Value


Smart Water Managemen

Economic Value

Increase hotel prices by **¥ 120/room**
Cultivate more than **10** new varieties of roses


Hotel

Social Value


President Xi's visit

Social Value

Form **7** industrial forms
Reduce stormwater risk by **70%**
News media shares surpassed **100,000**


1-year return period storm risk reduced by 100% , 20-year return period risk reduced by 70.03%