The Final Defense of Riverside Villages

Longquanwan Resilient Development Plan, Beijing, China

Project Statement

Project Title: The Final Defense of Riverside Villages, Longquanwan Resilient Development Plan

Project Size: 3.36km^2

Project Location: Longquanwan Section of Yongding River, Mentougou District, Beijing, China

Nestled at the edge of Beijing, Longquan Bay marks the last river bend of the Yongding River as it transitions from the mountainous regions into the plains. This unique geographical setting, where upstream runoff converge, serves as the final bastion against the mountain floodwaters for Beijing, playing a critical role in safeguarding the city and its surrounding agricultural communities with a deeply interwoven history.

The Longquanwan Resilient Development Plan emerges in response to the unprecedented July 29th, 2023, extreme flood, transforming Beijing's last natural defense against mountain floods into a beacon of resilience. Spearheaded by landscape architects in collaboration with local communities and government,the project takes advantage of post-disaster restoration to address inequities caused by historical development in areas with few development resources and high risk of rain and flooding through nature-based solutions.The plan focuses on fostering sustainability of safety, ecological stability, lifestyle adaptability and developmental flexibility. By returning commandeered lands to nature and the people, and introducing multifunctional nature-based solutions, the project not only solves immediate vulnerabilities but also reimagines the area's future, ensuring its resilience against climate change while promoting social equity and environmental stewardship.

Project Narrative

Background

Longquanwan, located in Mentougou District, Beijing, China, is the last curved river section of the Yongding River's Shanxia section. The river section is 4.5km long, with an average width of 100m, and a total rural planning land area of 3.36 km^2, including Longquanwu Village, Junzhuang Village, and Chenjiazhuang Village.

This area is a pivotal area where the Beijing city's expansion intersects with the suburban mountains, embodying a crucial site for environmental resilience and urban safety. This locale serves as the final natural barricade of the Yongding River against mountainous floods, impacting the fate of three local communities: Chenjiazhuang, Junzhuang and Longquanwu. The project transformates Longquanwan from a region afflicted by disasters to a paradigm of resilience encapsulates. It’s not just recovery but also a progressive template for sustainable and equitable rural planning.

Historical Challenge Exposed: An Environmental Justice Expositor and Prophet of Future Disasters

On July 29th, 2023, Mentougou District witnessed an unprecedented extreme rainfall event, the likes of which had not been seen in 140 years. Through a detailed site survey, owing to the long-term neglect and poor planning of the Longquanwan region, this calamity caused severe mountain floods and revealed a devastated landscape where severe erosion and sediment deposition sprawled over 12 hectares, 95% of water management infrastructure lay in ruins, vegetation across 297,600 square meters was obliterated, and over 40 villages needed reconstruction. Mud and debris accumulation reached 24,800 cubic meters, and 245,000 square meters of embankments were destroyed, leaving behind more than 13,400 square meters of rubbish. The deluge dismantled roads and bridges in surrounding villages, erasing 1.1 kilometers of riverside roads, and decimating 90% of the recreational areas along the riverbanks. In the wake of the disaster, Longquan Bay was left in a state of fragility, screaming for urgent restoration and reevaluation of its environmental and infrastructural integrity.

Labelled as "A Revealer and Prophet," the flood exposed the compounded issues of environmental neglect and social inequity. The conversion of riverlands into unauthorized golf courses intensified the flooding and revealed the area's inequalities. The reason why the Longquanwan area was so badly damaged by flooding was not only because of the intensity of this rainfall, but also because of the high regional flood risk caused by the encroachment of riverine land. The land at the bend of the river at the critical node was originally a natural floodplain, but in the course of historical development, the public land at this location has been encroached upon, and much of the area has been elevated and converted into a golf course, which has resulted in a narrowing of the river's flood corridor, a dramatic increase in the flow rate of the river, and a reduction in the ecological resources of the neighbouring villages, while at the same time assuming a much higher risk of flooding. The flooding was a disastrous combination of land encroachment and extreme rainfall.
Predictions from the CMIP6 models also show current defenses are inadequate, necessitating a visionary approach to counter future flood risks. Longquanwan embodies the imperative for a renewed connection with nature, promoting resilient, sustainable, and equitable development, echoing our shared duty to future generations and the environment.

Project Narrative

Visionary Planning: Bridging The Past and The Uncertain Future

The Longquanwan Resilient Development Plan, orchestrated by landscape architects, communities and the government, emphasizes four pillars: sustainability of safety, ecological stability, lifestyle adaptability, and developmental flexibility, all aimed at fostering resilience and equity for local villages in the uncertain future.
(1) “Sustainability of Safety” emphasizes the safety of the Riverside Village and the river in the event of extreme weather conditions in the uncertain future;
(2) “Ecological Stability” aims to increase the resilience of the region's ecosystems in the face of extreme natural hazards;
(3) “Lifestyle Adaptability” seeks to restore the human-river connection that existed in the past, using the restored river as a medium to increase the abundance of green space and physical activity for the villagers;
(4) “Developmental Flexibility” means to provide diversified development opportunities for the three neighboring villages and towns based on the inequitable distribution of regional resources and risk distribution, so that the villages and towns will have sufficient funds to withstand disasters and build recovery.

Towards Resilience and Equity: A Nature-based & Community-Centric Approach

By employing post-disaster remnants, the strategy utilizes multifunctional, nature-based solutions to forge safer, ecologically vibrant, and aesthetically pleasing waterways. Within a landscape hydrology perspective, by utilizing and resisting water flows, four practices have been devised to modify and utilize water flow: (1) prefabricated concrete revetment, (2) rock & brushwood revetment, (3) meander creation, (4) flow deflector. The flood-derived sediment and mountain debris like branches and stones are repurposed as material for revetments and high-density wooden deflectors, strengthening the riverbanks against erosion and guiding water flow. By creating meander, the flood-damaged golf course can be transformed back into floodplains leveraging the river's curved channel circulation. These multifunctional efforts boost biodiversity and public spaces, each positioned through hydrodynamic analyses for enduring safety and resilience.

The floods dismantled the encroached golf courses, presenting a unique chance for creating public recreational spaces. We facilitated the reclamation of these areas for nature and the local villagers, addressing resource distribution inequities and enhancing flood defenses. This intervention not only alleviated the unfair distribution of developmental resources but also played a crucial role in flood management. Building on this foundation, our plan emphasizes the integration of more natural and higher-quality ecological resources with rural projects, offering the village diversified industrial development options. This approach advocates for integrating superior ecological resources with rural projects to bolster economic growth and disaster recovery capacity for the community.

Connected Future Shaped by Landscape Architecture

By prioritizing ecological diversity, water management, and community engagement, the Longquan Bay initiative set a new standard for how landscape architecture could play a pivotal role in crafting sustainable futures. Garnering accolades from residents and recognition from Beijing Municipal Bureau, this approach has successfully transformed Longquan Bay into a model of sustainable and equitable development. The project exemplifies the combined power of landscape architecture and community participation in revitalizing ecological health, community safety, and economic vitality, showcasing the effectiveness of collaborative models in overcoming environmental and social inequalities.

A Flood Wreaked Havoc on Longquanwan in Beijing

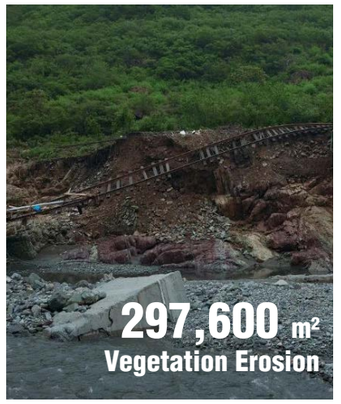
Laoyugou
Xiashuiyu
Liushigang
Xinkaicun
Gaoyakou
Wayao
Qiyuan
Langeryu
Beizhaotai
Hantai
Yubai
Sijiashui
Huoshanjian
Langdong
1290
Nanshancun
Miquan
Dagou
1178
Tanchang
Shangweidian
Yingtaogoucun
Dagongcun
Nanzhuang
Wangjiawan
Taoyuancun
Lingjiao
Huangtai
Anjiazhuang
Xiaweidian
Yongding River
Huiyu
Xiyangtuo
Xincun
Dongshanxia
Lunzhuang
Chenjiazhuang
Longquanwan
Dancun
Dongjiatan
Longquanwu
Qingshuijian
Dongtaoyuan
Wangping
Seshufen
Miaofeng
Shuiyuju
Liuliqu
Datai
Daoxu
Dongluopo
Wangpingkou
Anjiatan
Guacaodi
Nangang
858
Cheng
Donglongmen
Shigang
Beijing
Baidaozi
Qiangfengpo
Guantingcun
Tiantiaofu
Donxinfang
Sanjiadian
Heishitou
Wulitou
Moshikou
Batangzi
Sidaqiao
Heigang
Caodiazhuang
Wanfotang
Liyuanzhuang
Wulonggang
Nanxinfang
Dongcun
Kelun
Wangcun
Tanzhesi
Donghexian
the Sixth Ring Road
Transitional zone between shallow hill and plain
the Fifth Ring Road
the Third Ring Road
12km
16.9km
19.8km

Villagers Are Still at Risk, Longquanwan, Mentougou District, Beijing

As of July 29, 2023, the city of Beijing was impacted by Typhoon DusuRui. The Mentougou District, situated in the northwestern part of Beijing, recorded an average rainfall of 538 mm. The floods impacted 310,000 people, damaged 26,493 houses, and left 40 villages in need of reconstruction. Efforts for post-disaster reconstruction are currently in progress. However, 63,100 villagers in Longquanwan, the designated planning area,still remain at significant risk of flooding.

ilt Accumulation: 66,000 m²

Only 1.1km of the Main Road Remained Operational

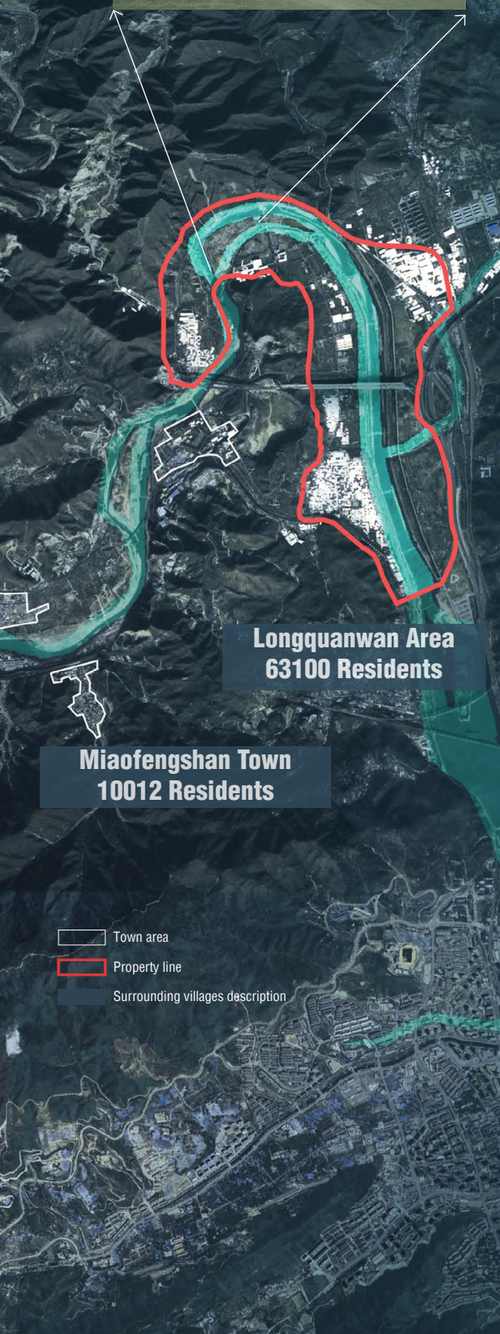


BUT WAS IT JUST A

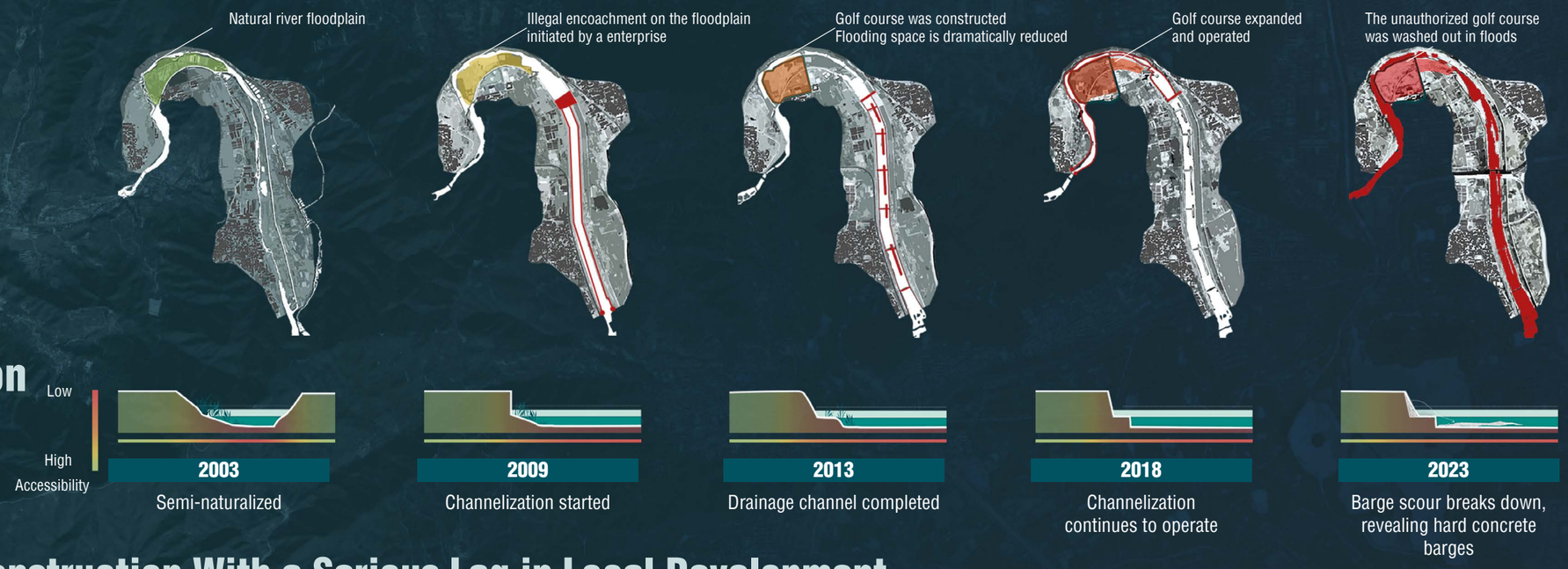
NATURAL DISASTER?

Flood Is Not Just a Flood, It Reveals Regional Inequity Issues

Rural areas like Longquanwan often face neglect and urban expansion, leading to marginalization. Historical data shows a pattern of regional inequality over 20 years. The Longquanwan area suffered severe flooding due to heavy rain and the high flood risk from river land encroachment. The natural floodplain at the river bend was altered, with land elevated for a golf course, narrowing the flood corridor, increasing river flow, reducing ecological resources, and raising flood risk. The disaster was a result of land misuse and extreme weather.



History Processes of Long-term River Intrusions And Canalization



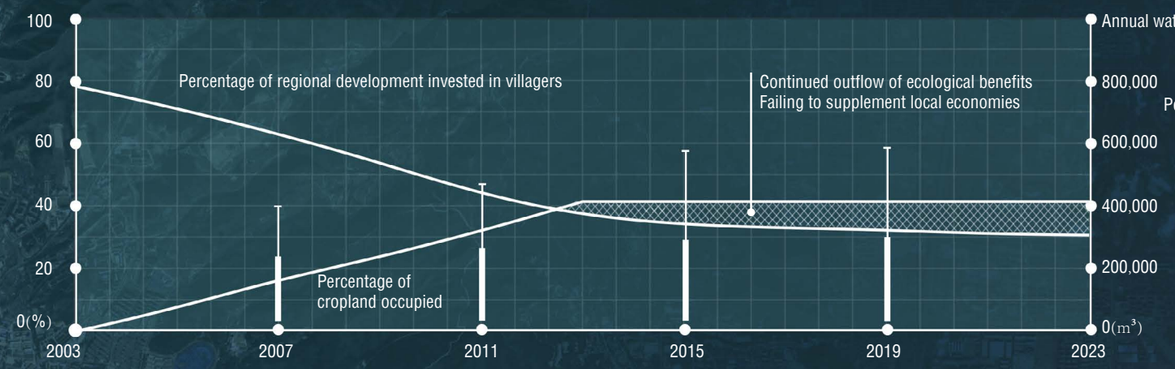
Historical Construction With a Serious Lag in Local Development

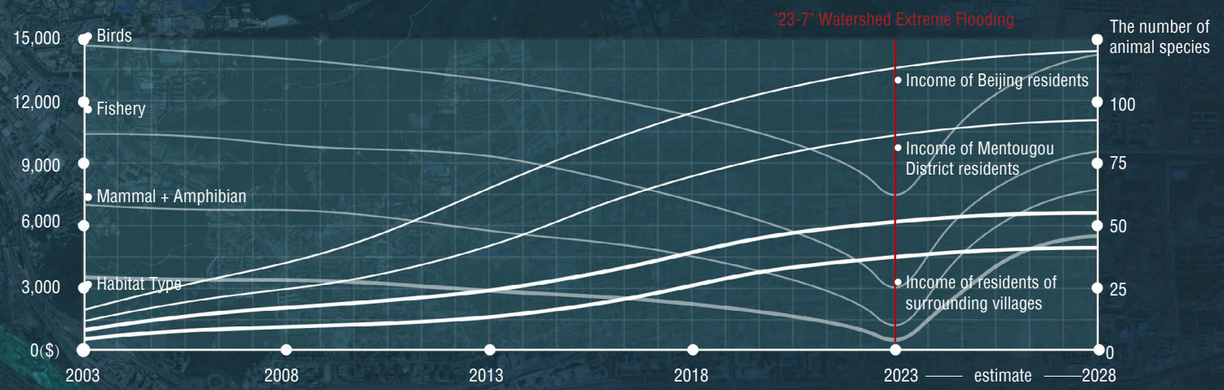
Challenge 1

Arable lands and riverlands were increasingly appropriated for golf course construction without the resulting revenues enhancing the local villagers' quality of life. Additionally, these courses consume vast quantities of water annually, causing significant environmental harm.

Challenge 1

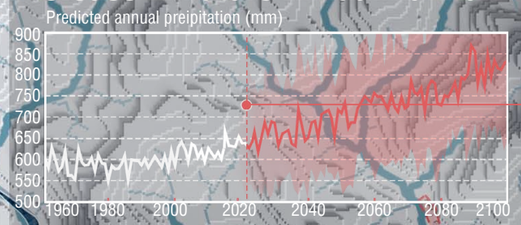
The development of golf courses and river channeling constrains the opportunities for community-based ecological revenue generation. A substantial disparity exists between the residents' earnings and the city's average income.



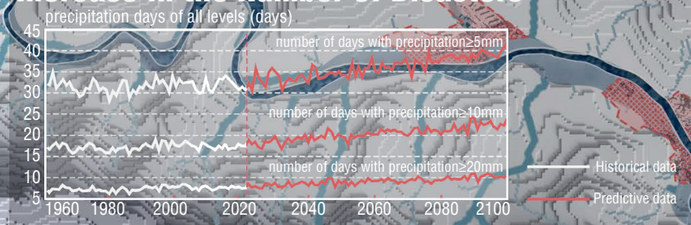


Flood Is Not Just a Flood, It Signals the Future

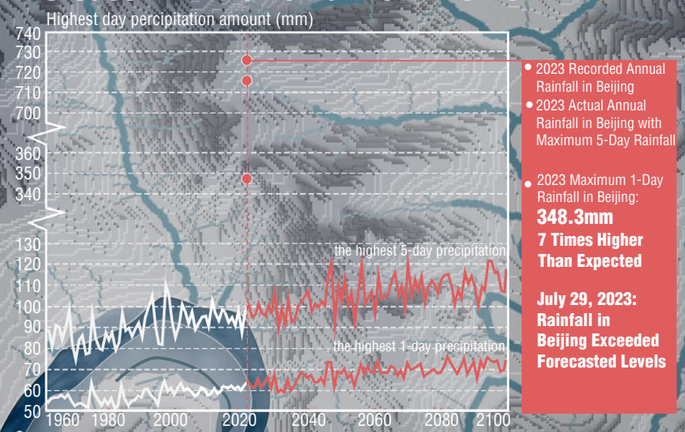
Increase in Future Annual Rainfall



Increase in the Number of Disasters



Increase in Extreme Rainfall Events



peak discharge
3234.97m³/s

peak discharge
3451.03m³/s

peak discharge
3414.66m³/s

peak discharge
3274.94m³/s

peak discharge
3360.18m³/s

peak discharge
3555.27m³/s

peak discharge
3679.18m³/s

Site location
The last bend before entering the plain

peak discharge
3751.21m³/s

Yongding River Road
23.7 Extent of flooding
rainfall runoff
Village settlement
Flooded village

Climate projections from CMIP-6 for the next century indicate a clear increase in total rainfall and the frequency of rain events in the North China Plain. However, a 140-year rainfall event in Beijing delivered **7 times** the forecasted amount in a single day, with the river's peak flow exceeding **300 times** that of the annual average. **This trend suggests rain and flood disasters will become more frequent and severe in the future.**

River Restoration Project Spearheaded by Landscape Architects

Project Construction Participation Component

The landscape architects led collaborative efforts with the government, community, and social organizations to reconstruct residents' homes post-disaster. Engaging in ongoing dialogue, landscape architects incorporated villagers' suggestions, effectively restoring the natural environment. This collaborative approach received governmental recognition.

Project Leader: Landscape Architect

Landscape architects facilitate collaboration among all stakeholders to generate the project plan

Government Sector
Landscape Architects Liaise with Senior Government Officials Agencies,

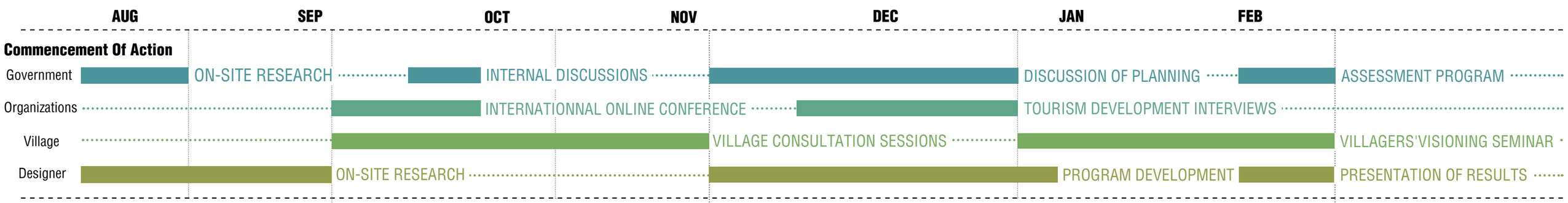
+

Village Residents
Landscape Architects and Gardeners Coordinate Public Engagements

+

Other organizations
Stakeholder Discussions Involving Tourists and Organizations

35 Government-led project promotion sessions	**70** Letters of assignment issued by the Government	**563** Face-to-face encounters for tourists	**15** On-line meetings organized by various parties
850+ Public open houses + door-to-door survey	**322** Perceptions and visions of project results	**100+** Number of participants in programmatic discussion sessions	**10** Programmatic workshops




Government Mobilization Meeting




Survey of the affected site

Survey of the affected site


Tourism Development Interviews



International Online Conferences

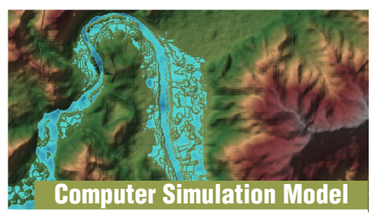

Villager' Visioning Seminar


Villager' Visioning Seminar



Villager' Visioning Seminar


Designer Program Generation

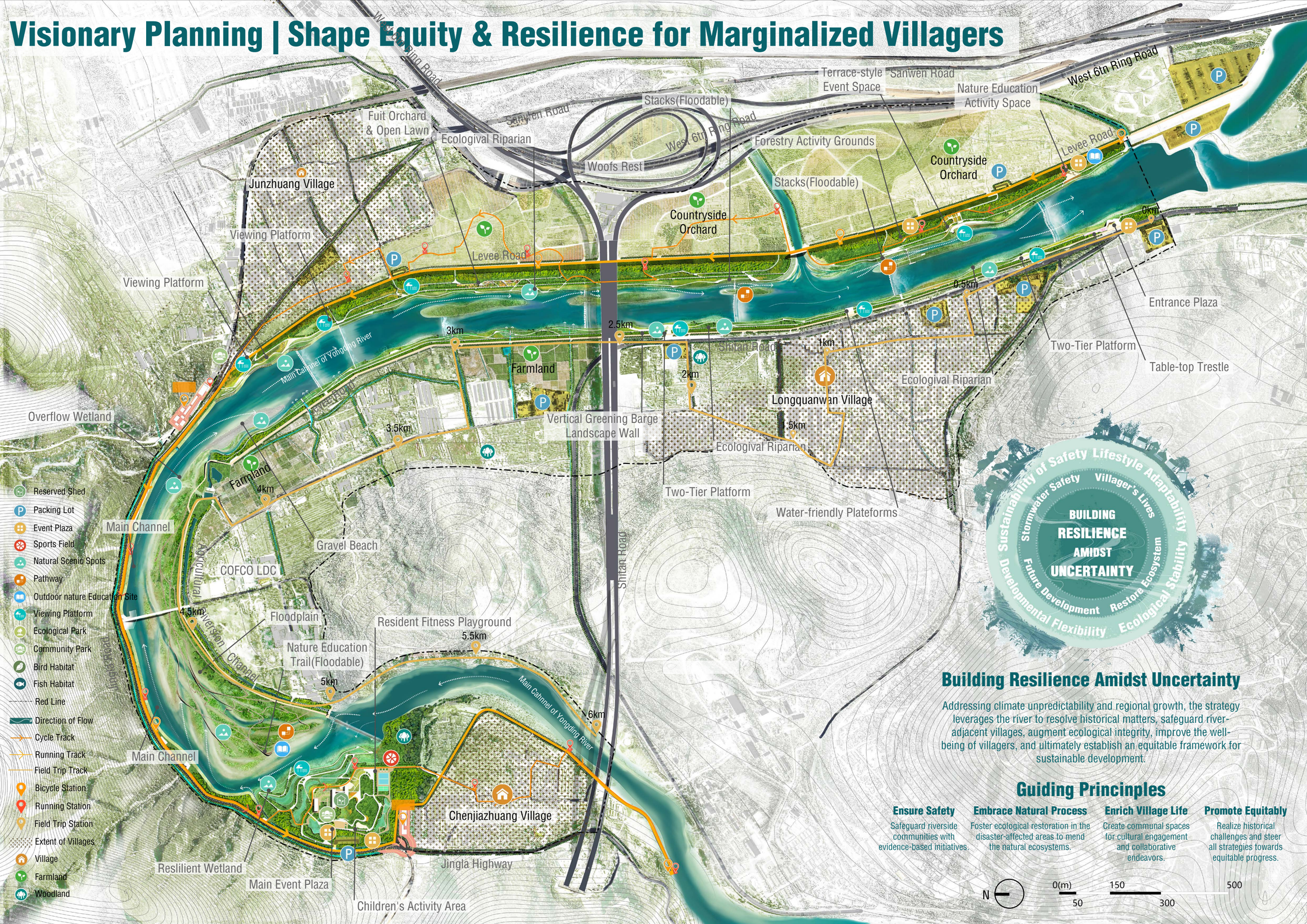

Computer Simulation Model


Computer Simulation Model


Designer Program Generation


Programmatic Workshops

Visionary Planning | Shape Equity & Resilience for Marginalized Villagers



Building Resilience Amidst Uncertainty

Addressing climate unpredictability and regional growth, the strategy leverages the river to resolve historical matters, safeguard river-adjacent villages, augment ecological integrity, improve the well-being of villagers, and ultimately establish an equitable framework for sustainable development.

Guiding Principles

Ensure Safety
Safeguard riverside communities with evidence-based initiatives.

Embrace Natural Process
Foster ecological restoration in the disaster-affected areas to mend the natural ecosystems.

Enrich Village Life
Create communal spaces for cultural engagement and collaborative endeavors.

Promote Equitably
Realize historical challenges and steer all strategies towards equitable progress.

Resilience-based Planning Will Bring Diverse Benefits to the Region

Expected Benefits

Ensure safety for three villages in next **150** years against climate change

Revitalize the river ecosystem, increasing species diversity by **162%**

Construct **3** new parks and add **19,637** m^2 of riverfront green space

Reallocate **206,256** m^2 of land to villagers and redefining the area's development plan

Implement the Plan: A Nature-Based Approach

By employing post-disaster remnants, the strategy utilizes multifunctional, nature-based solutions to forge safer, ecologically vibrant, and aesthetically pleasing waterways. Within a landscape hydrology perspective, by utilizing and resisting water flows, four practices have been devised to modify and utilize water flow:
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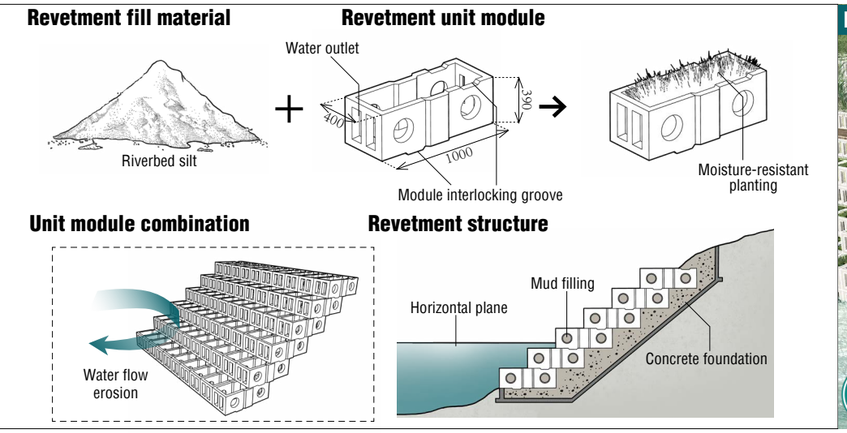
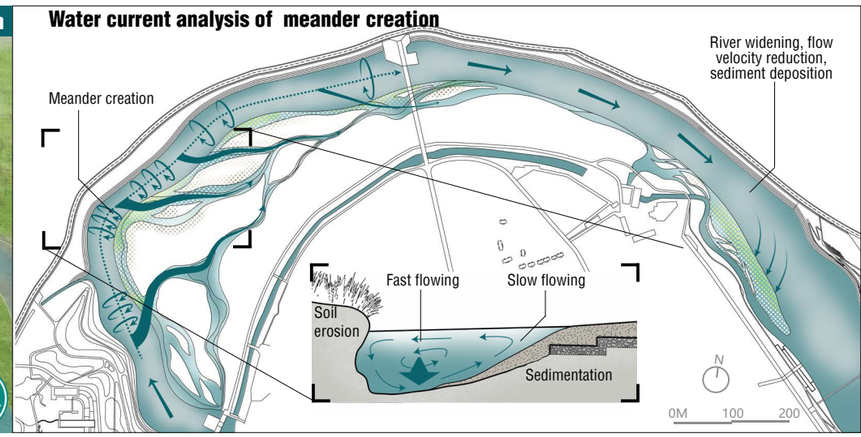
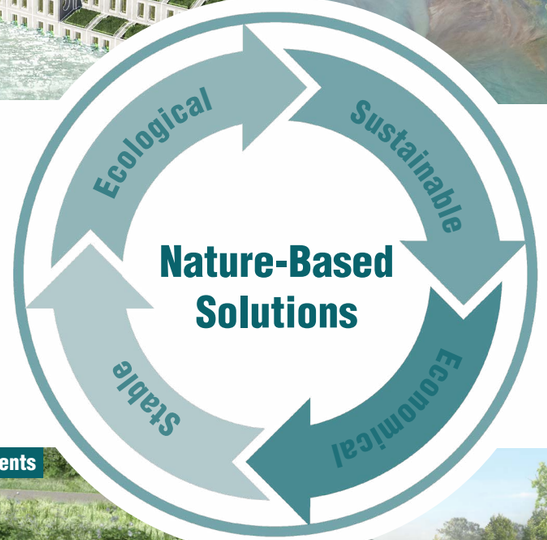




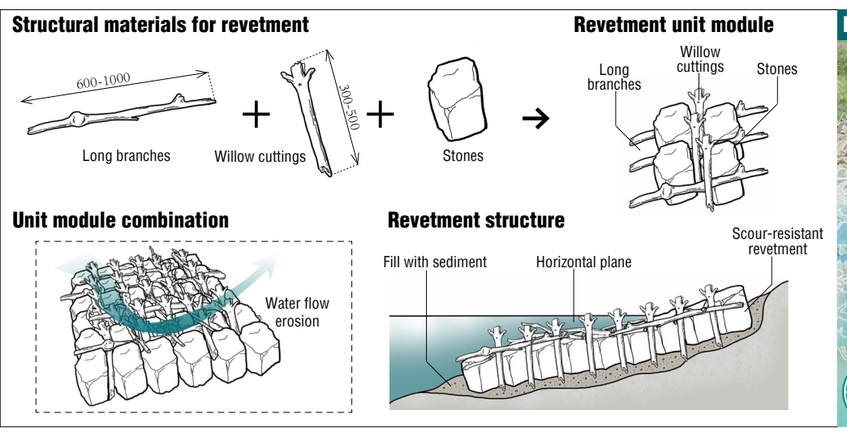
Alteration of River Flow

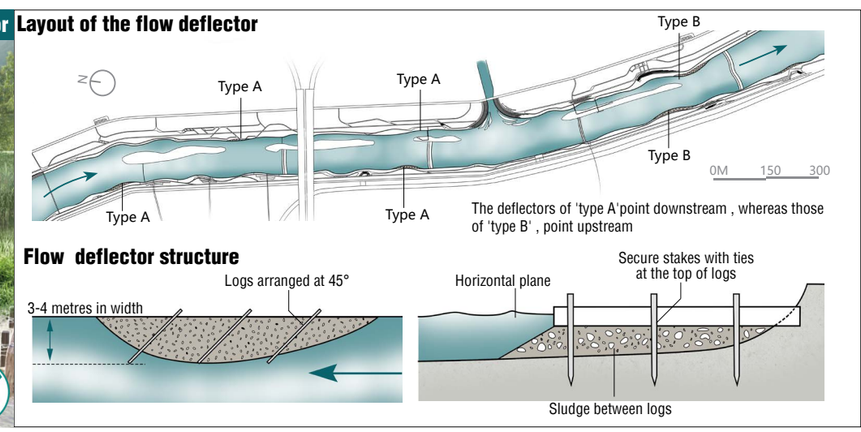
Harvest and repurpose on-site materials, usingriverbed silt for prefabricated concrete revetment fills. Integrate vegetation planting to stabilize and green the riverbank, thereby curbing soil erosion. Employ leftover stones and branchesto build rock & brushwood revetments, reducing their erosion.



Utilization of River Flow

Divert upstream water into the floodplain, creating meanders to create trapezoidal platforms that aid in sediment accumulation, consequentlydecreasing downstream sediment levels. Place flow deflectors to develop revetment wetlands,thereby augmenting the ecological value of riparian green areas.

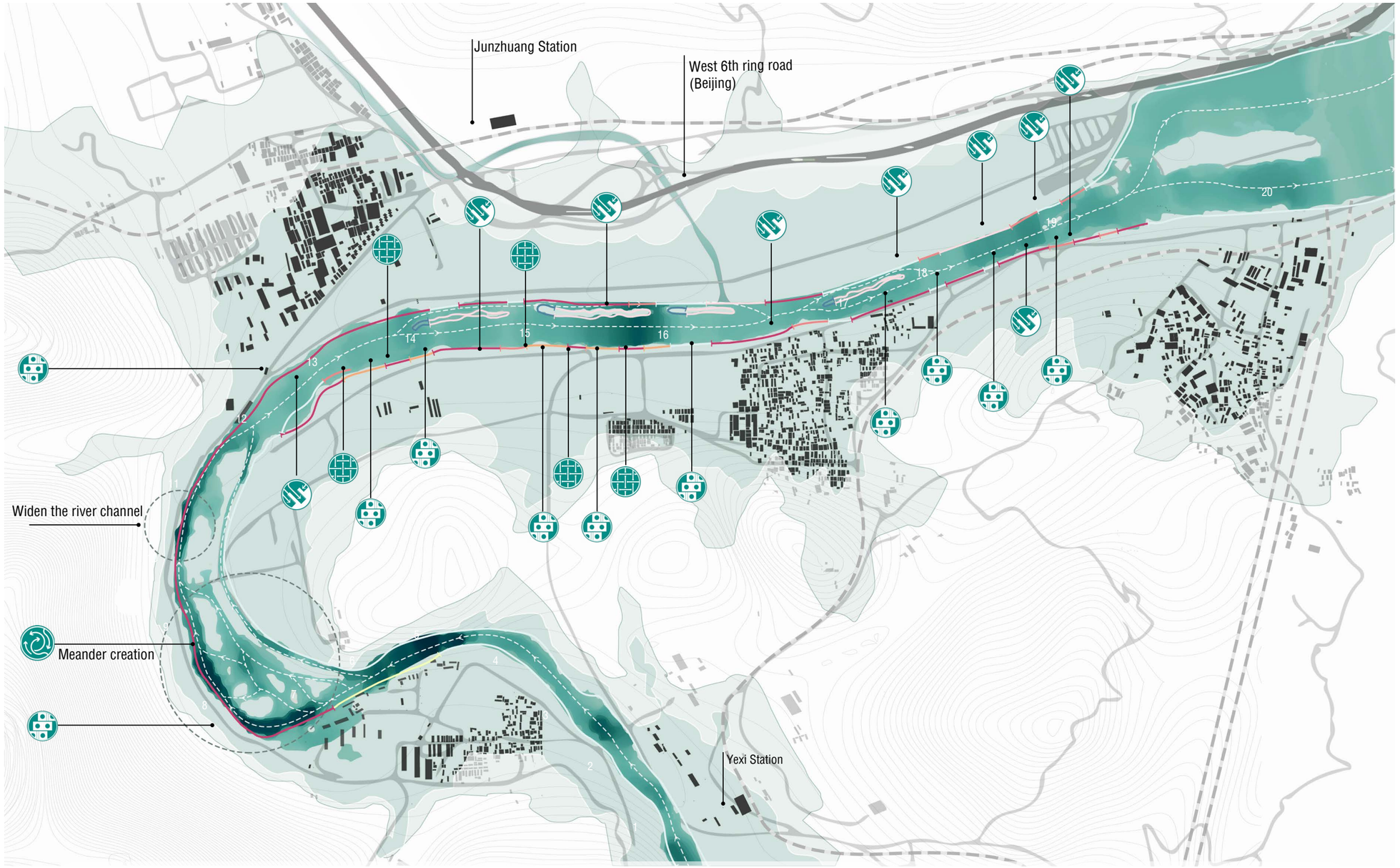


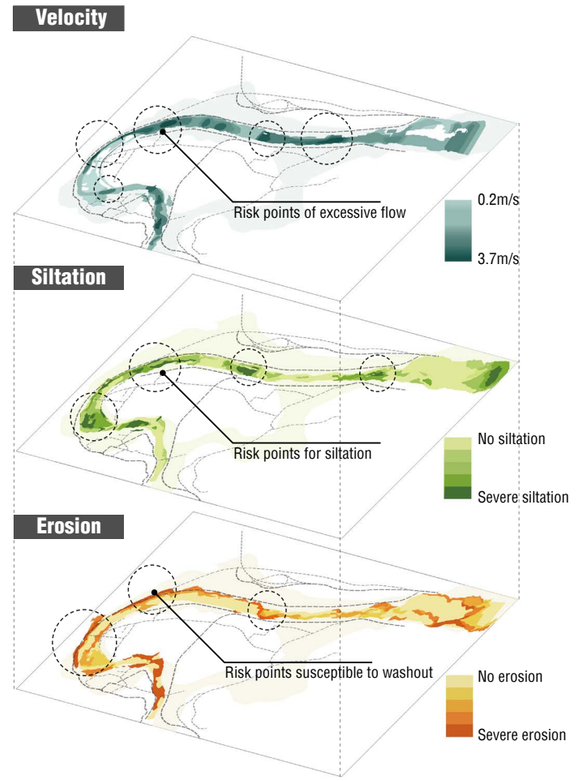


Resilience 1: Insureing Riverside Villages' Safety Against Diverse Rainfall Conditions

Scientifically placing practices through HEC-RAS alleviates future stormwater risks in riverside village.

The project used hydrodynamic software to simulate a 100-year flood in the Yongding River channel and targeted the areas of high velocity and strong scouring simulated by the software to arrange facilities that can slow down the velocity and enhance the buffer, as well as to guide the flood peaks through meander creation to increase the over-water area, so as to safeguard the safety of the riverside villages.

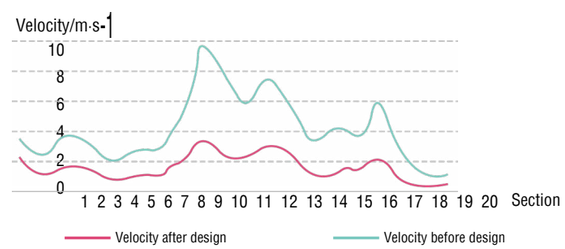




125 HECTARE — Engineered river channels to safeguard 124.92 hectares of residential areas from floods.

46.7 TIMES — Flood-prone zones within designed channels diminished from 13.1 hectares to 3.2 hectares, marking a 46.7-fold reduction.

62.4 PERCENT — Peak flow velocity reduced from 9.8 meters per second to 3.7 meters per second, a 62.4% decrease.



Legend

- Prefabricated Concrete Revetment
- Rock & Brushwood Reventments
- Flow Deflector
- Stone Cage Cushion
- Reinforcement at Dam Diversion Terminus
- Traditional Revetment
- Reed Roll Slope
- Direction of Water Flow
- Houses Not Affected by Flooding
- Houses Beyond Flood Zones
- Existing Floodplain
- Potential Future Floodplain
- Rock & Brushwood Revetments
- Flow Deflector
- Prefabricated Concrete Revetment
- Meander Creation

Resilience 2: Restoring Stability of River Ecosystems to Improve Ecological Stability

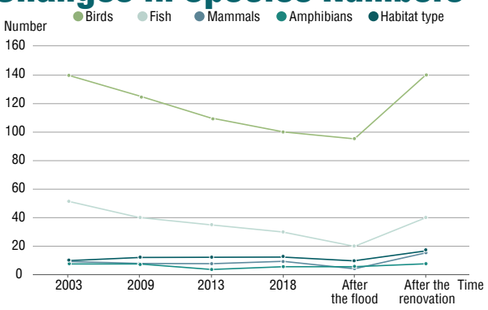
Applying meander circulation principles to turn an unauthorized golf course into a floodplain with native species enhances river ecosystem stability.

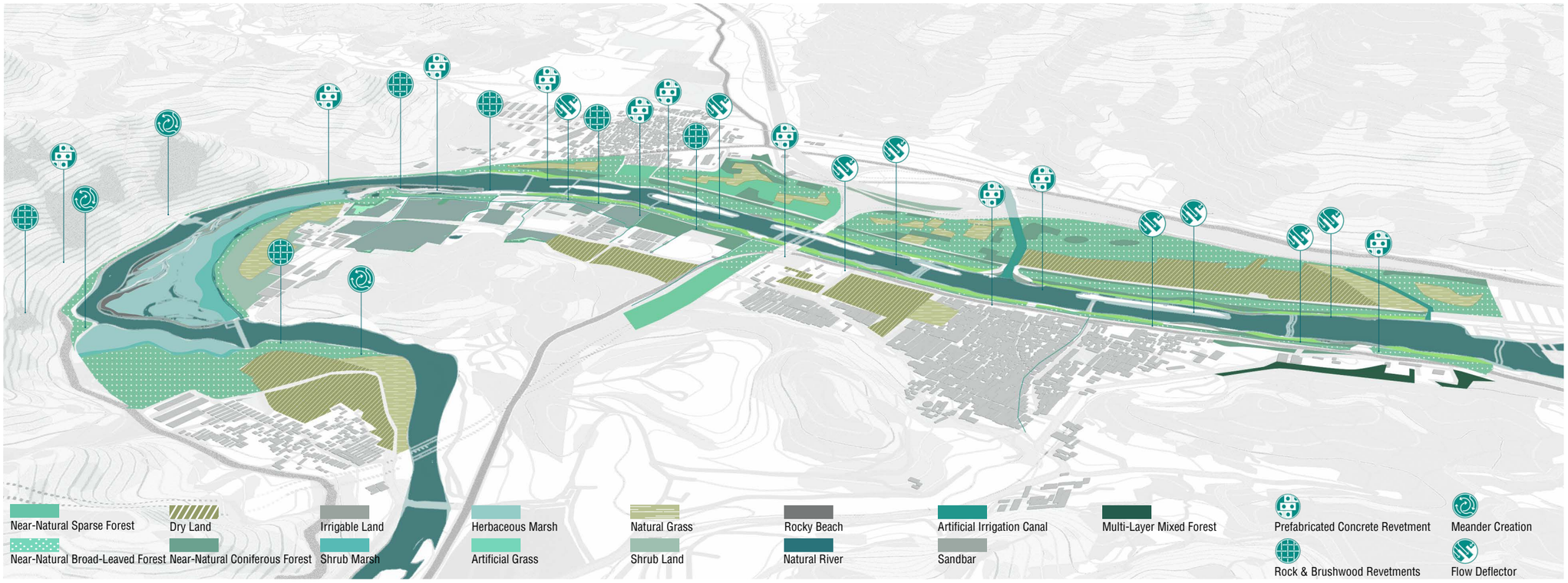
The project is based on river simulation to install diversion facilities in areas prone to siltation. It also incorporates the creation of meanders to restore the original encroached channel to a natural floodplain. The new floodplain will be able to self-guide the accumulation of river sand to form new habitats that will attract multiple native species and enhance species diversity.

15 TYPES — Plan to construct 15 types of habitats to enhance the diversity of biological habitats.

162 PERCENT — Achieved a 162% increase in biodiversity, bolstering the ecosystem's self-regulation capability.

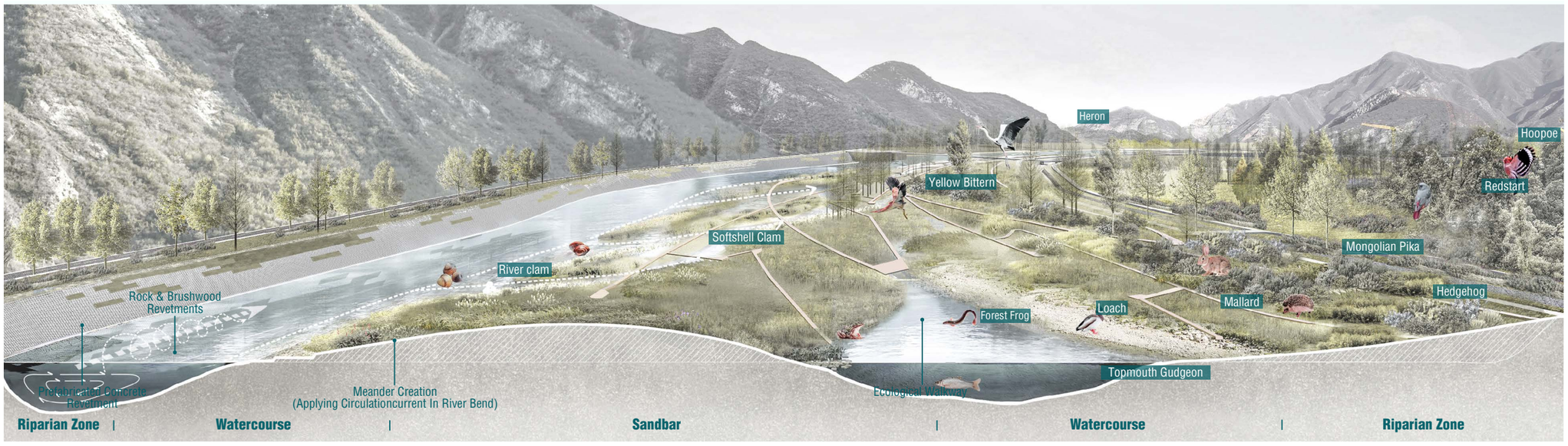
Changes in Species Numbers





Existing Issues on the Site

1. High water flow velocity at the concave bank,where curved circulation occurs, results in significant revetment erosion.
2. River sediment buildup raises water levels, causing floods that inundate riverbanks, accumulate debris, and damage vegetation extensively.
3. The curved flow causes substantial soil erosion at the concave bank, damaging green spaces severely during floods.
4. While curved circulation leads to sediment deposition at the convex bank, it is readily washed downstream, causing river blockages.



Resilience 3: Enhancing Lifestyle Adaptability and Enriching the Residents' Lives

Enhancing site accessibility and utilizing flow deflectors to create new green spaces facilitates activities for all seasons and all ages.

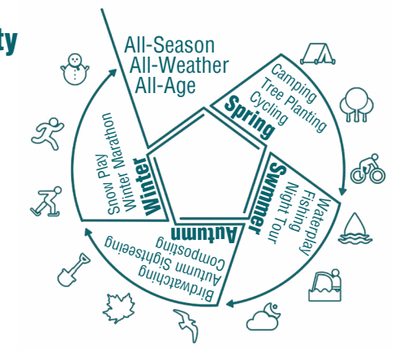
The project rehabilitated the roads on both sides of the river and reorganised and planned a five-category road system, interconnecting public car parks in the three communities with the river to enhance villagers' accessibility to the river. And the team also makes use of the arrangement of facilities to backfill the washed-out river green space. Finally the new river green space as well as the reclaimed golf area will be open to all villagers and provide an equitable green space for environmental justice.

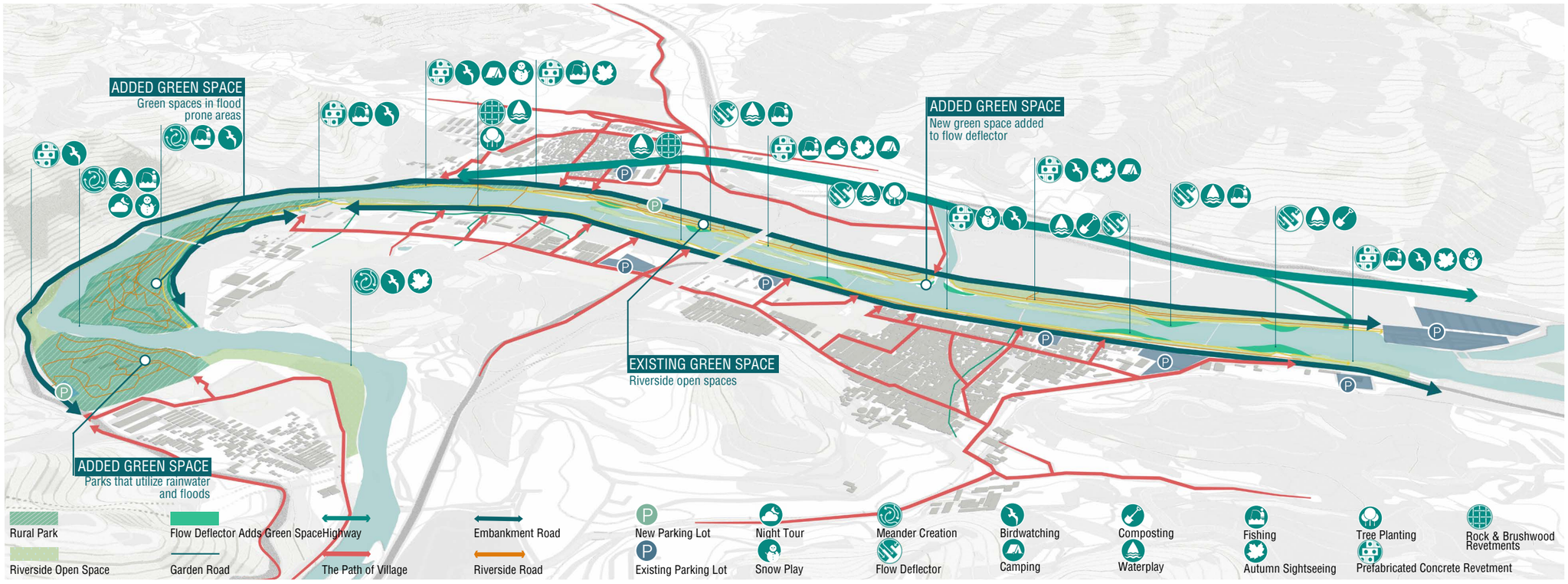
2 PARKING LOTS — Establish two parking lots in the central and western regions to better accommodate the site's parking demands.

5 CATEGORIES — Enhance five categories of road systems to improve connectivity between the site and adjacent roads.

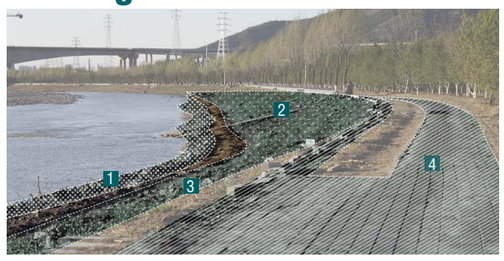
19637 SQUARE METERS — Added 19,637 square meters of riverfront green space with the construction of three new rural parks.

Activity types

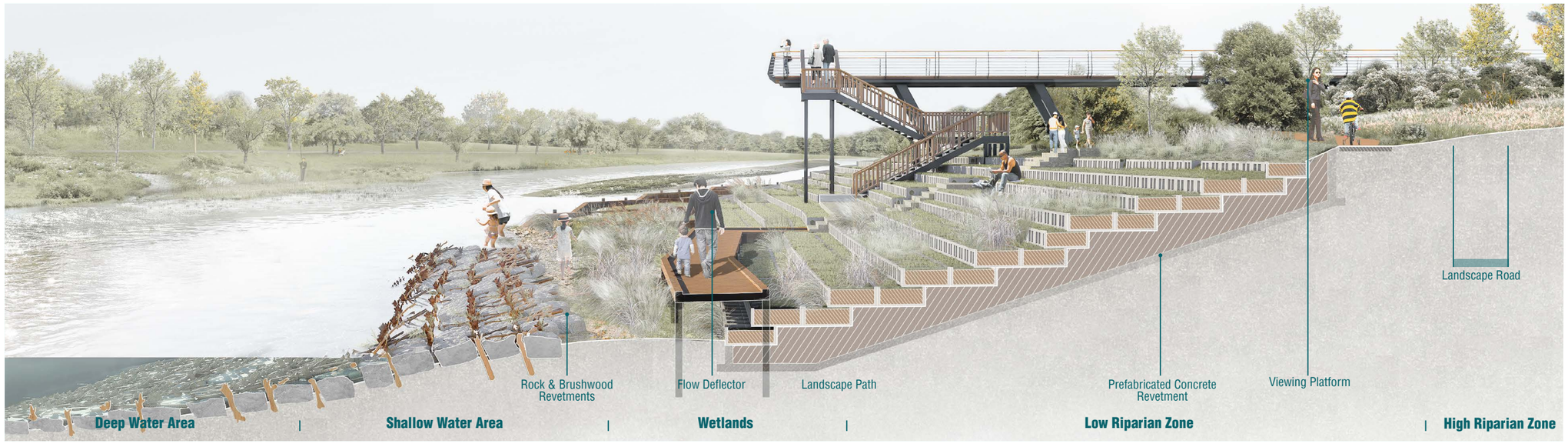




Existing Issues on the Site



1. The serious channelization of the river and the rapid water flow have caused embankment erosion and soil degradation.
2. Floods have washed away the water-friendly staircase, reducing access to waterfront areas.
3. The lack of waterside roads contributes to significant soil compaction, impairing the site's water permeability.
4. The river's flood resistance capacity is relatively low, flooding inflicts considerable damage on the scenic roadway.



Resilience 4: Ensuring Equitable and Diverse Possibilities for Village Residents

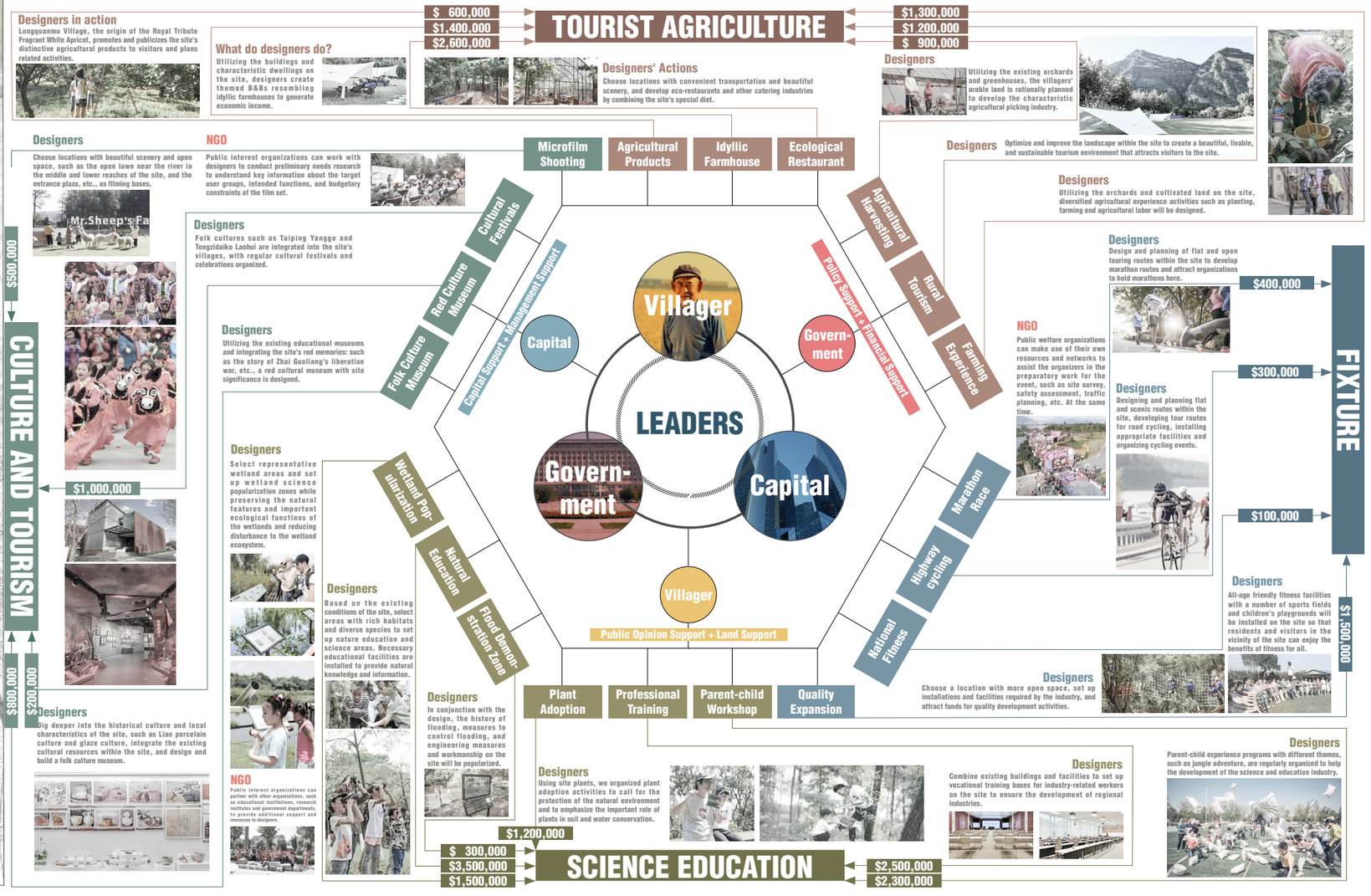
Returning river resources to villagers and providing them with new development models to enhance post-disaster rehabilitation capacity.

The project is based on the security of the village, the enhancement of the ecology and the increase of green space activities, shaping an area that can be developed in a diversified manner.
The project returns the original encroached land to the villagers for utilisation and development, and combines the villagers, the government and the capital city's industries to provide a variety of development paths for the villagers, which not only provide more flexible options for uncertain policy development, but also increase the economic income of the area to enhance the future self-rebuilding ability after the disaster.

Reallocating Land and Water Resources to Communities

Redistributed **186,672** square meters of river areas and **206,256** square meters of oases to the community.

Leading Roles and Related Industries



Revitalized River Corridor Offers Safe and Enjoyable Water Spaces for All Ages

The reconstructed river corridor combines natural practices with existing hydraulic features to create areas of varying flow velocities. Natural sites and paths are placed around low-flow areas to provide safe, water-friendly spaces for people of all ages.

6KM Strengthened Shoreline

8KM Water-friendly Paths

15+ Safe Water-play Zones

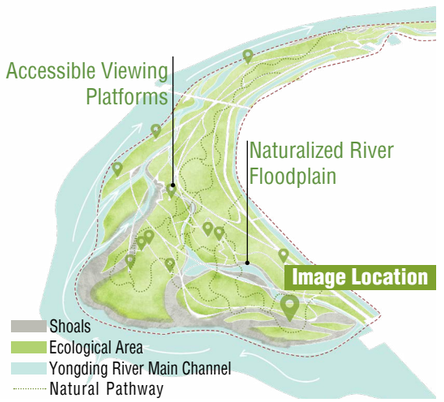
Transform the Washed-Out Golf Course into a Restored Floodplain for Nature and Public

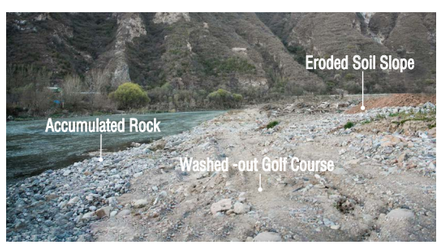
The washed-out private golf course was reconstructed as a public natural floodplain.
The reconstructed floodplain enhances flood management, ecological restoration, and provides ecological resources for the villagers.

20+ Kinds of Attracted **Animals**

20ha Restored **Floodplain**

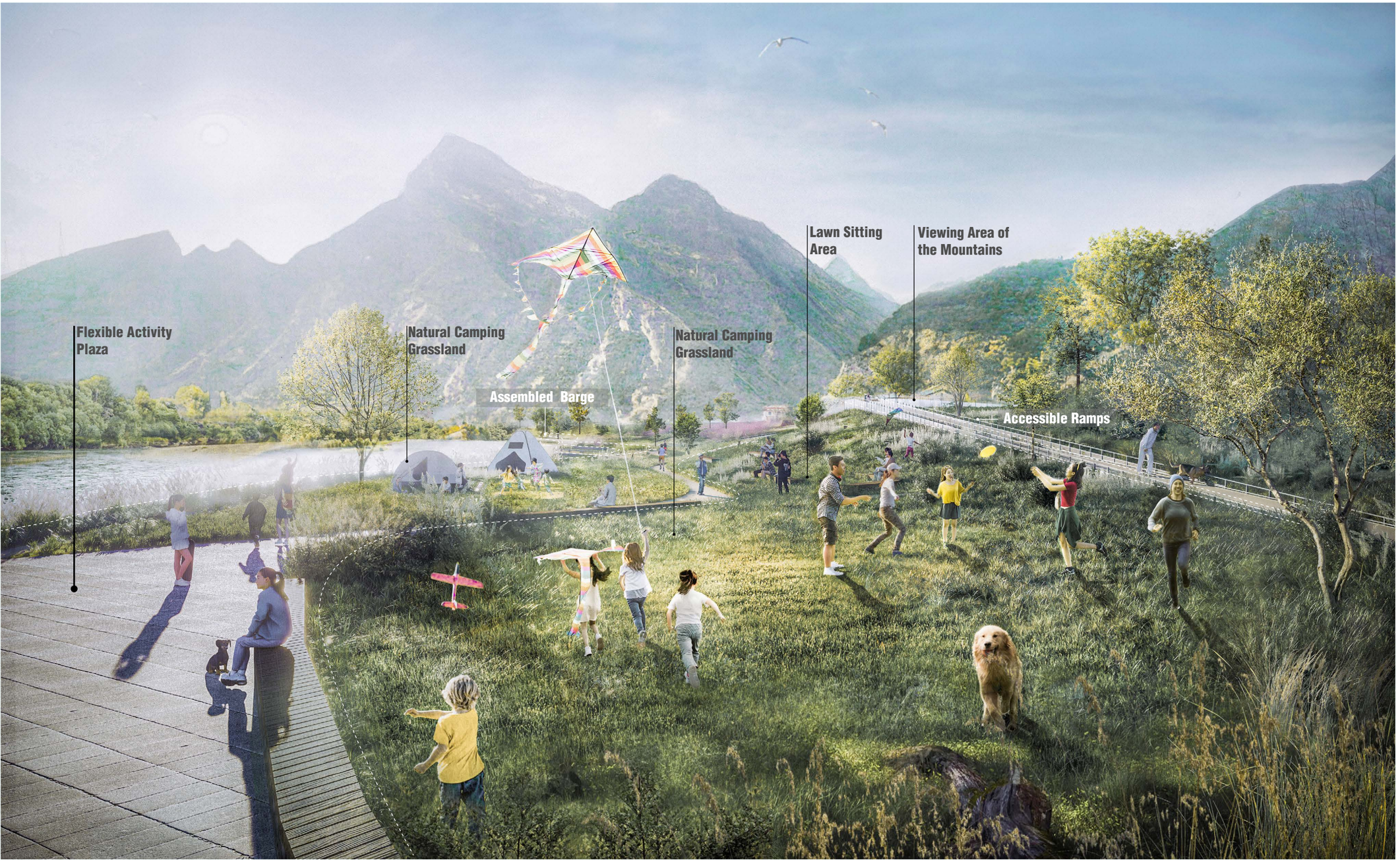
12+ Nature Discovery **Trails**





Newly Established Rural Parks Offer a Variety of Activities for Community Engagement

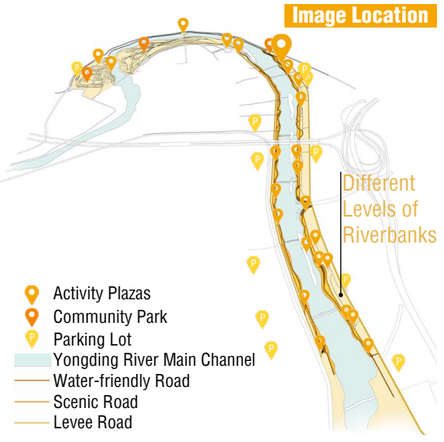
By improving the road system of surrounding communities and restoring green spaces on both sides of the river, the project established multi-level activity spaces and rural parks, enriching the villagers‘s cultural life.



25+ New Planned **Plazas**

10+ Public **Parking Lots**

3+ Levels of activity **Riverbanks**



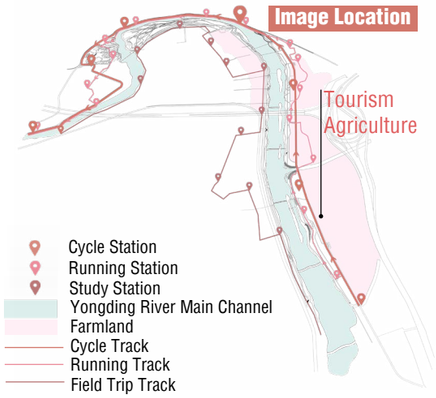
Reconstructed Roads Can Provide Venues for Village-organized Tournaments And Events

The project's focus extends beyond the river and incorporates surrounding roads into the regional development plan.
By opening up previously closed rural boundaries, the project prepares the area for future diversified industrial development.

5KM Riverside Running Track

7KM Riverside Bicycle Track

30+ Village Service Stations



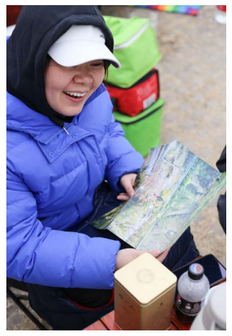
Social Co-construction Led by Landscape Architects to Provide Development Prospects

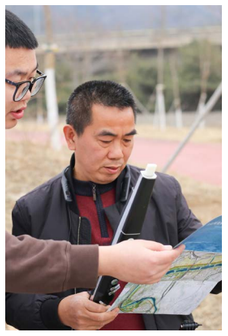
Return Visit
We made a return visit to the village residents and presented the designed plan to them.

River safety along the Yongding is paramount; only then can we consider green parks. It's important for our children to grow up with nature and parks. I hope the parks near the village will nurture my children as well.

We need park facilities that are practical for our everyday lives!

There's ample room in the park for us seniors to rest and move about. Elderly people also need our own space to be active and play.





Stimulate Imagination
Residents envisioned recreation along the newly renovated Yongding River and offered more opinions.

The Project is Expected to Be Recognized by The Public and Swupported

Ensuring water safety while increasing greenery along the river.

I wish the park had seats and trash cans to make the park cleaner !

Flower and Duck ! Quack Quack ...

I want to embrace nature! Back to nature!

I want the freedom to play with my dog in this park.

I wanted a safe tour of the river's riding paths.

We want to set up hammocks on the waterfront barge.

VILLAGE SAFETY & RIVER SAFETY
Employing natural methods to construct a secure river channel will offer better resilience in the event of floods.

NATURAL RIVER HABITATS
Natural methods are employed to restore the river's vitality, allowing for the continuous growth of ecological habitats within the river ecosystem.

ACTIVITIES & EVENTS
The golf course has been returned to the villagers, enhancing their enjoyment of outdoor activities and enriching their lifestyle with increased options.

WORK JOBS & INDUSTRIES
The revitalization of the river has engaged more community members, brought additional industrial opportunities to the neighboring villages, and created more jobs for the residents.

Estimated Benefits

$9,456,704.35
per year Gross Village Income

The project aims for a more diversified industrial development in the village, creating diverse employment opportunities that enhance the village's economic resilience and ensure equitable growth.

84% Village Land

Villages will have protection against climate change impacts for the next 100 years.

70% Time Shortened

Accessibility of the village area to the river can be improved through new planned roads and parking lots.

15 Habitats

Habitat restoration is possible through eco-friendly infrastructure and the establishment of new plant ecosystems.

60+ Activity Spaces

New plan will create additional recreational spaces for village residents.

200+ River Species

Stream species can be increased by integrating ecological principles into infrastructural developments and planting.

1500 Job Chances

The new plan will launch more community projects, anticipated to generate additional employment opportunities for villagers.