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Director-General

Water Resources Agency, MOEA

TAIWAN INT'L WATER WEEK

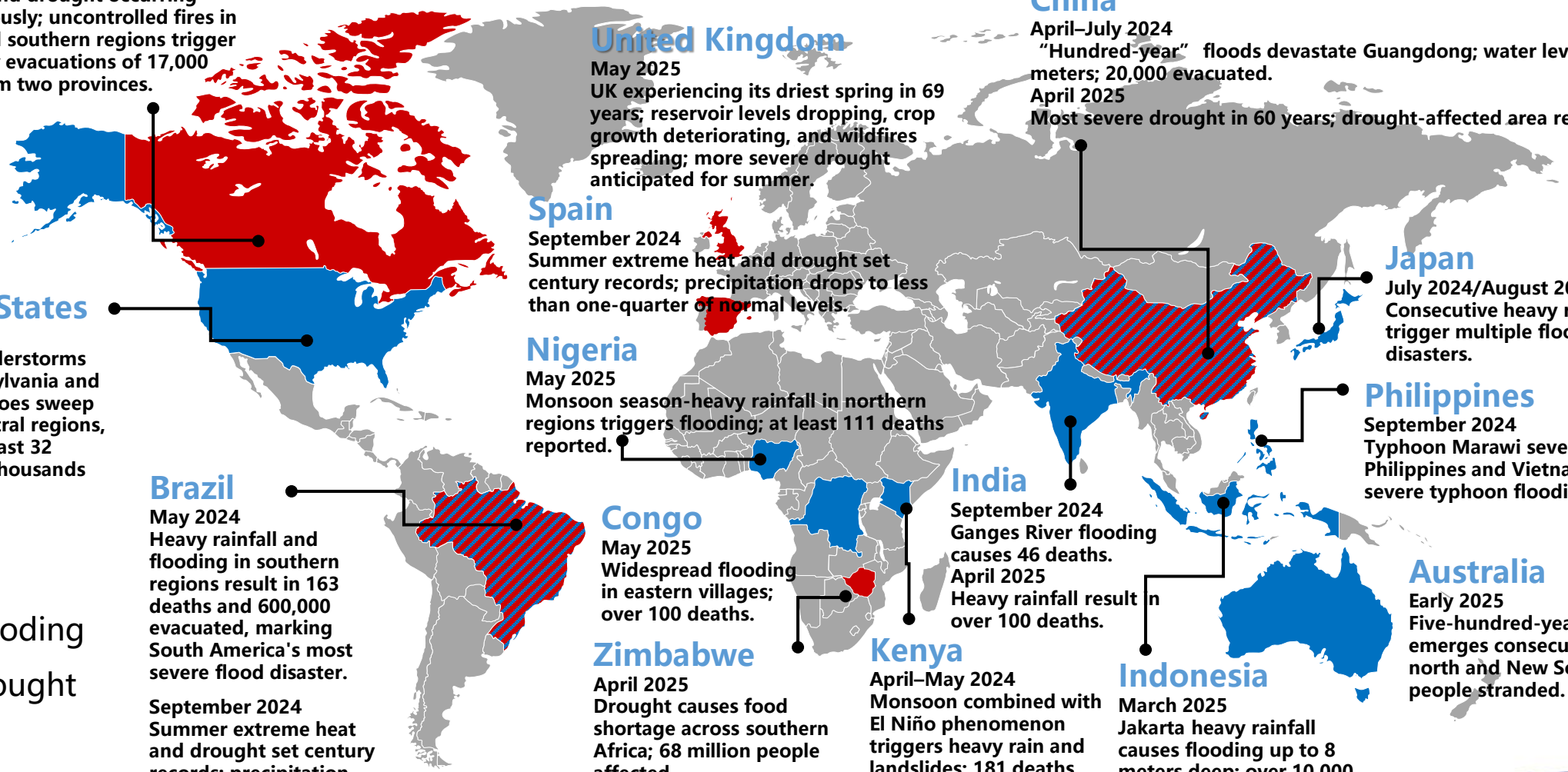
# Smart Watershed, AI-Driven Innovation

**Yuan-Peng Lin**
**Director- General**
Water Resources Agency
Ministry of Economic Affairs, Taiwan

28 October 2025

# 1 Current and Future Challenges

# Natural Context Global Intensification of Extreme Climate Events and Accelerating Water and Drought Disasters



## Canada
May 2025
Wildfires and drought occurring simultaneously; uncontrolled fires in central and southern regions trigger emergency evacuations of 17,000 people from two provinces.

## United States
May 2025
Severe thunderstorms strike Pennsylvania and Ohio; tornadoes sweep through central regions, causing at least 32 deaths and thousands injured.

## Brazil
May 2024
Heavy rainfall and flooding in southern regions result in 163 deaths and 600,000 evacuated, marking South America's most severe flood disaster.

September 2024
Summer extreme heat and drought set century records; precipitation drops to less than one-quarter of normal levels.

## United Kingdom
May 2025
UK experiencing its driest spring in 69 years; reservoir levels dropping, crop growth deteriorating, and wildfires spreading; more severe drought anticipated for summer.

## Spain
September 2024
Summer extreme heat and drought set century records; precipitation drops to less than one-quarter of normal levels.

## Nigeria
May 2025
Monsoon season-heavy rainfall in northern regions triggers flooding; at least 111 deaths reported.

## Congo
May 2025
Widespread flooding in eastern villages; over 100 deaths.

## Zimbabwe
April 2025
Drought causes food shortage across southern Africa; 68 million people affected.

## China
April–July 2024
"Hundred-year" floods devastate Guangdong; water level exceed 55 meters; 20,000 evacuated.
April 2025
Most severe drought in 60 years; drought-affected area reaches 97.5%.

## India
September 2024
Ganges River flooding causes 46 deaths.
April 2025
Heavy rainfall result in over 100 deaths.

## Kenya
April–May 2024
Monsoon combined with El Niño phenomenon triggers heavy rain and landslides; 181 deaths, nearly 200,000 evacuated.

## Indonesia
March 2025
Jakarta heavy rainfall causes flooding up to 8 meters deep; over 10,000 evacuated.

## Japan
July 2024/August 2025
Consecutive heavy rainfall and typhoons trigger multiple flooding and landslide disasters.

## Philippines
September 2024
Typhoon Marawi severely impacts Philippines and Vietnam; 796 deaths, most severe typhoon flooding in 20 years.

## Australia
Early 2025
Five-hundred-year event; severe flooding emerges consecutively in Queenslands north and New South Wales; 50,000 people stranded.

Flooding

Drought

# Social Context Water Resources Management Facing Significant Challenges



## Urban Population/Industrial Concentration

Concentrated urban populations increase water demand and heighten disaster risks. Economic and industrial development drive continued growth in water consumption.

## Labor Shortage, Declining Birthrate, Aging Population

Declining birthrate, aging population, and labor shortage necessitate industrial transformation and digital transformation as emerging trends.

## Balance Between Resilience and Environmental Conservation

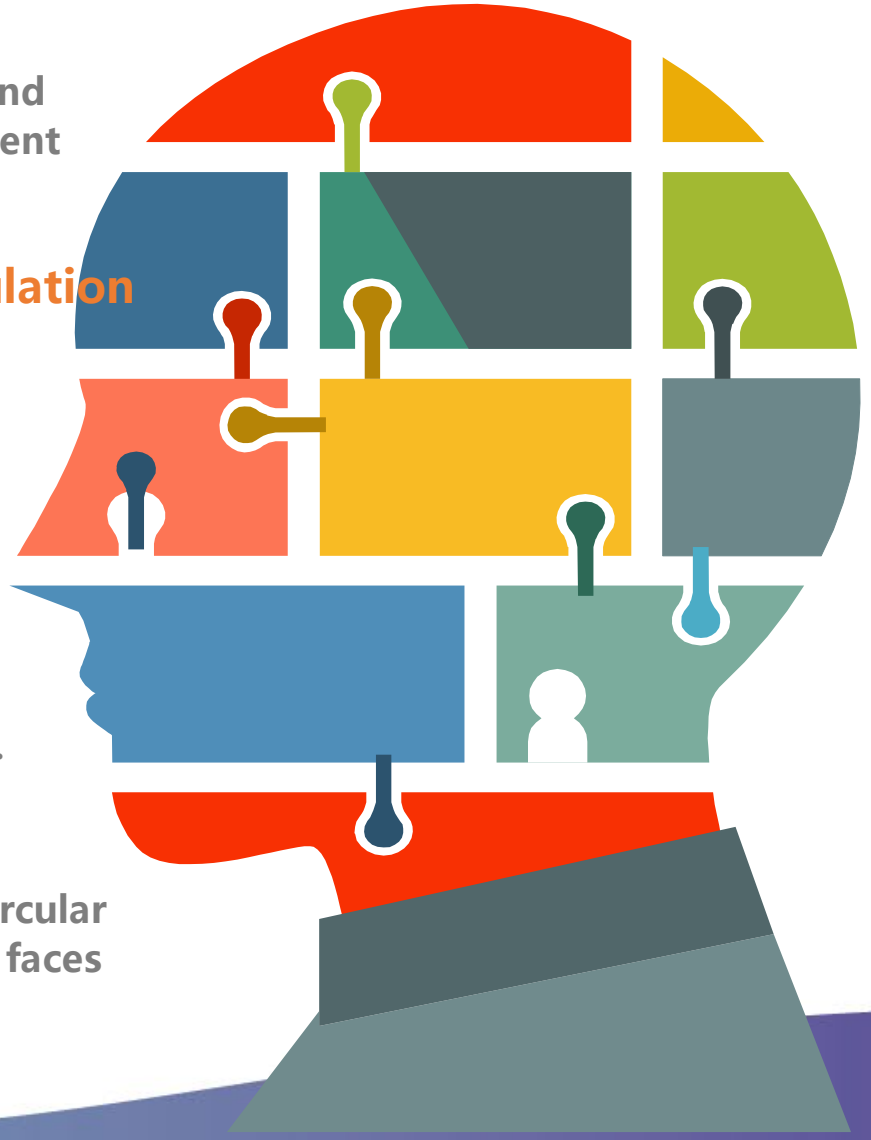
NbS

Rising environmental awareness elevates public expectations for water environments; water management must transition toward nature-based adaptation solutions.

## Net-Zero Transition

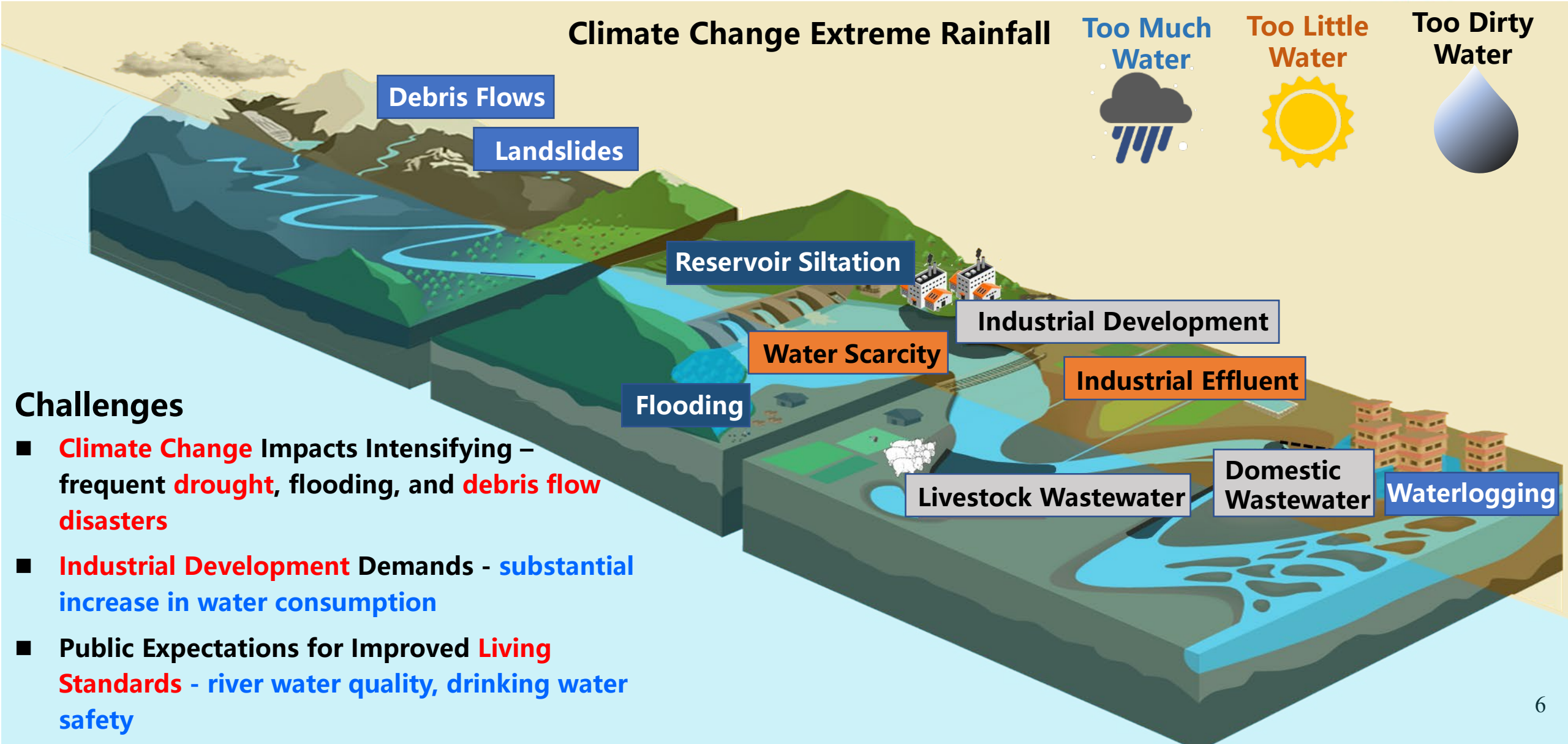
Net Zero

Facing policy objectives of low carbon, negative carbon, circular economy, and energy transition, water management work faces transformation challenges.



# Rapid Internal and External Environmental Changes Intensifying Watershed Water Environment Impacts






## Challenges

- Climate Change Impacts Intensifying – frequent drought, flooding, and debris flow disasters
- Industrial Development Demands - substantial increase in water consumption
- Public Expectations for Improved Living Standards - river water quality, drinking water safety

# 2 Key Strategies

# 4 Key Strategies of Smart Watershed Transformation

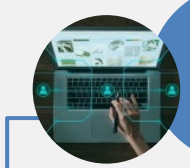
Smart Watershed, AI-Driven Innovation 智慧流域 AI領航 International Forum 2025

## Strengthen Integrated Watershed Management
**Water and Watershed Sustainability Task Force**

- Integrate resources from all ministries
- Inventory critical watershed issues
- Evidence-based governance and spatial data analysis
- Formulate management strategies and align resources

## Promote Resilient Water Engineering
**Diversified Water Sources & Integrated Water Systems**

- Develop diversified water sources and implement Pearl String Approach
- Maintain water supply and allocation capacity
- Runoff allocation and outflow management, establish secondary defense line
- Minimize flooding area, accelerate water recession, maximize safety

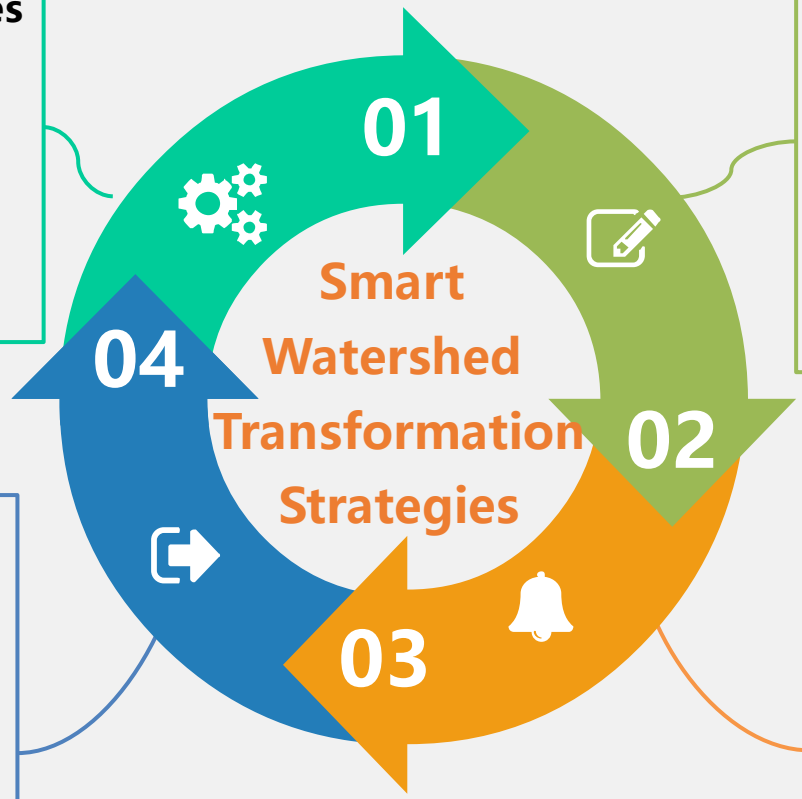


## AI Empowered Predictive Decision-Making
**Enabling Proactive and Synergistic Management**

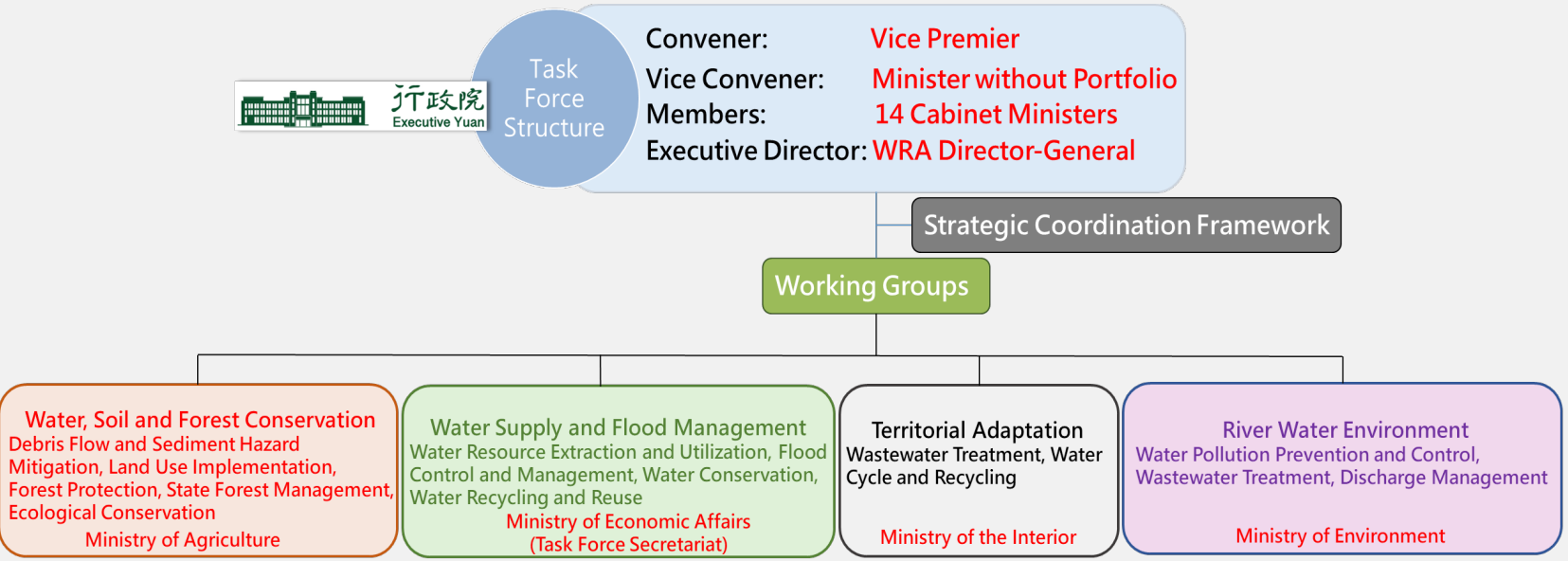
- Employ AI predictive models for Deep Learning
- Enhance Drought Early Warning and Flood Simulation
- Increase disaster prediction accuracy and scope
- Support disaster prevention and response decision-making

## Build Digital Sensing Network
**Establish Foundation for AI Analysis and Application**

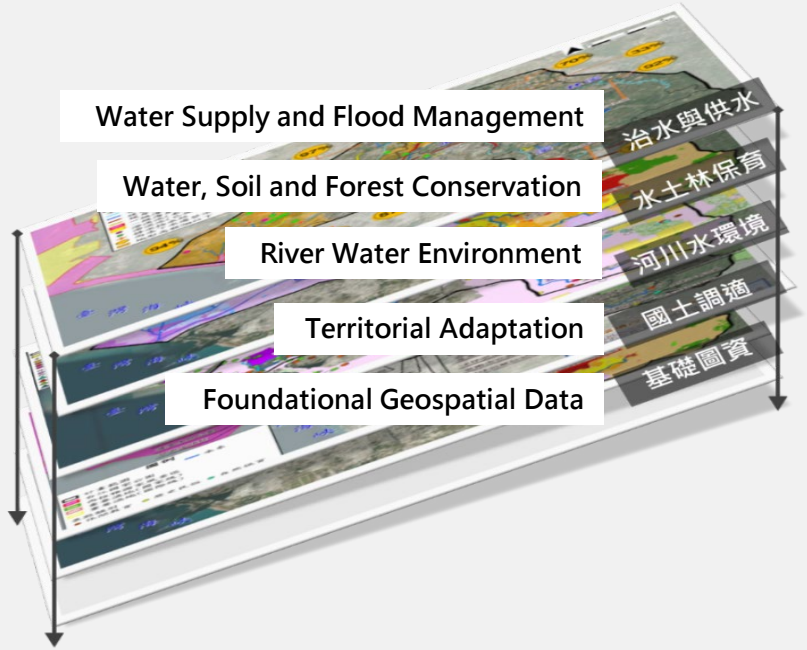
- Integrate IoT, 5G, radar, and satellite technology
- Establish high-density real-time hydrological information network
- Standardize water condition data and enable cloud infrastructure
- Implement open data access and digital information sharing



# Advancing Integrated Watershed Management Through the Water and Watershed Sustainability Task Force




# Evidence-Based Governance Framework Spatial Data Analysis




## Evidence-based Governance

**#1 Data-Driven Approach**

Consolidate geospatial information systems across all ministries; integrate geographic datasets and baseline mapping

**#2 Science-based Assessment**

Validate climate impact responses through scientific analysis; align risk, budget allocation, and climate scenarios.

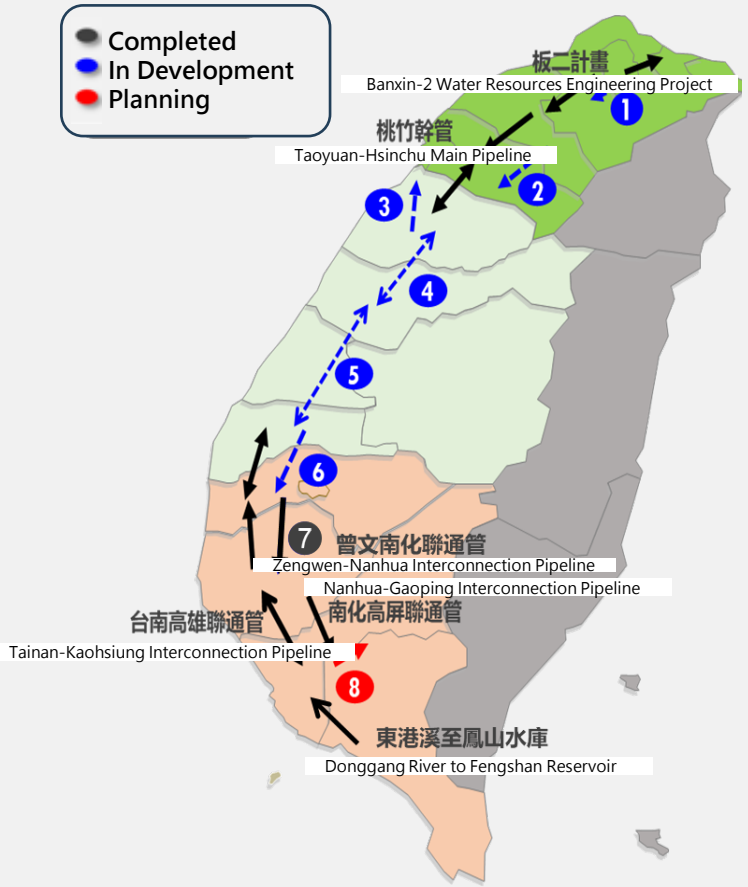
**#3 Systematic Planning**

Incorporate regional development priorities; formulate holistic strategies from watershed perspective; establish short-, medium-, and long-term management targets.

**#4 Integrated Program Development**

Prioritize resilience enhancement; consolidate inter-ministerial and local initiatives; concentrate resources on priority challenges.

# Promote the "Pearl Necklace" Interconnection Project and Diversified Water Sources to Meet Development Demands Through 2036




## Northern Region—

(Unit : tons/day)

Xindian River Water Source Southward Transfer

1.Water Supply Network Improvement in Sanchong and Luzhou Districts
(Phase 1 by 2028: +65,000 tons/day; Full completion by 2031: +200,000 tons/day)

2.Shimen Reservoir to Hsinchu Interconnection Pipeline
(Completion 2028; Shimen Reservoir Backup Supply to Hsinchu: +300,000 tons/day)

## Central Region—

Resolving Allocation Bottlenecks

3. Liyu Leke to Miaoli
(Completion 2025: +120,000 tons/day)

4. Daan-Dajia River Interconnection Pipeline
(Completion 2026: +255,000 tons/day)

5. Taichung to Yunlin Water Source Allocation Pipeline
(Completion 2029; Taichung-Changhua Allocation: +200,000 tons/day; Yunlin-Changhua Allocation: +120,000 tons/day)

## Southern Region—

Enhancing Water Source Utilization Efficiency

6. Zhuoshui Main Pipeline and Northern Main Pipeline Integration
(Completion 2025; Increased Annual Water Utilization: 11 million tons)

7. Zengwen-Nanhua Interconnection Pipeline
(Completed 2025; Allocation: +800,000 tons/day)

8. Kao-ping Pearl String
(Planning; Enhanced Bi-directional Kao-ping Allocation: +200,000 tons/day)

## Artificial Lakes


## Hyporheic Flow


## Reclaimed Water


## Desalinated Seawater


**Since 2017:** Daily supply increased by **2.37 million tons**, **Next 6 years:** Additional daily supply increase of **1.33 million tons**

# Five Core Strategies for Systematic Flood Control

## 1. Overall planning governance

Integrated Watershed Treatment Planning
Accelerate mid- and downstream reach rehabilitation

## 2. Enhance Land Flood Absorption Capacity

Runoff Allocation, Outflow Management,
On-site Detention

## 3. Prevent Flood Ingress into Residential Areas

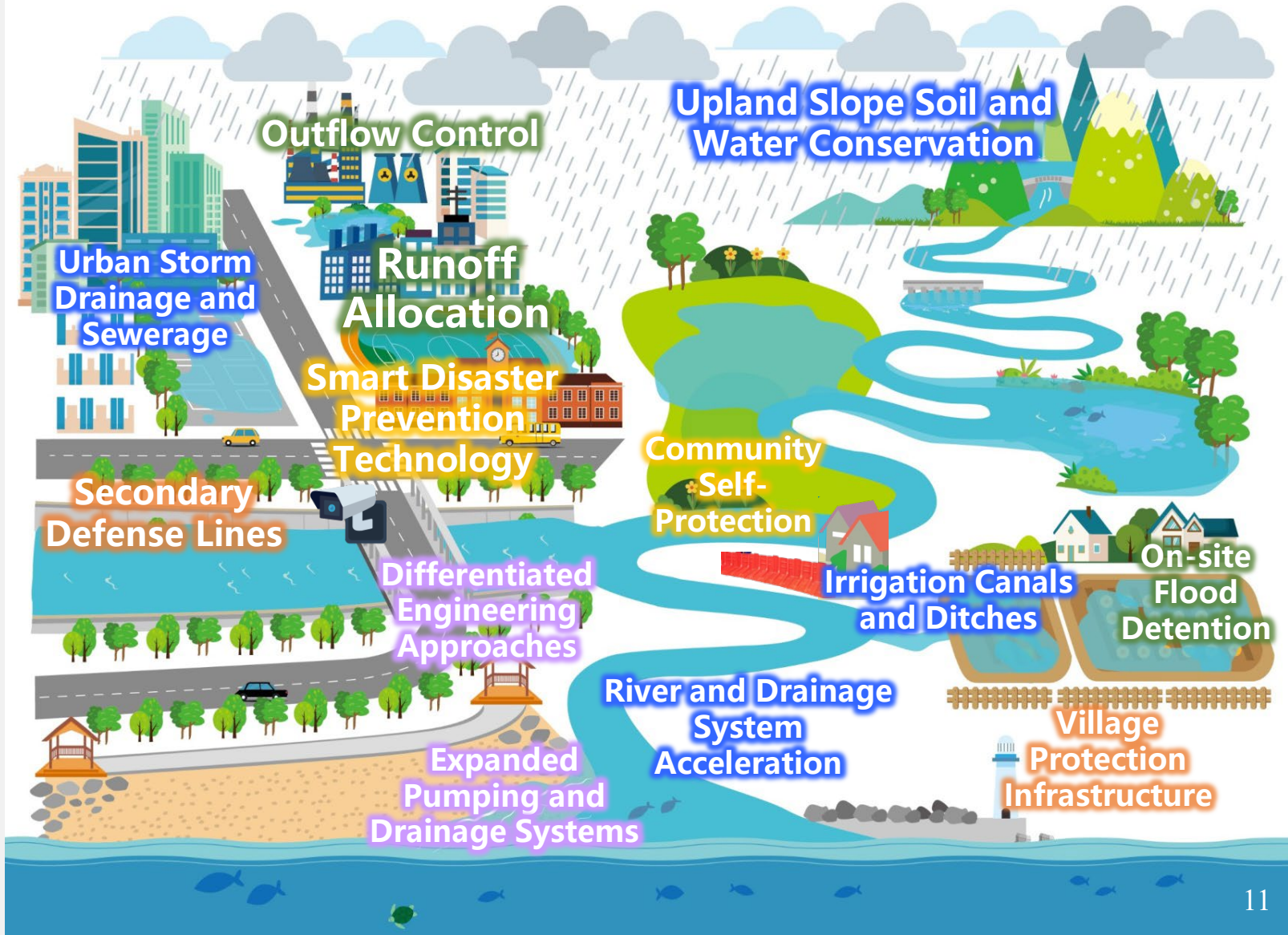
Deploy secondary defense lines, establish village protection measures

## 4. Accelerate Flood Recession

Expand pump and drainage capacity, implement differentiated Engineering Approaches

## 5. Disaster Preparedness and Response

Community self-protection initiatives, technology-enabled smart disaster management

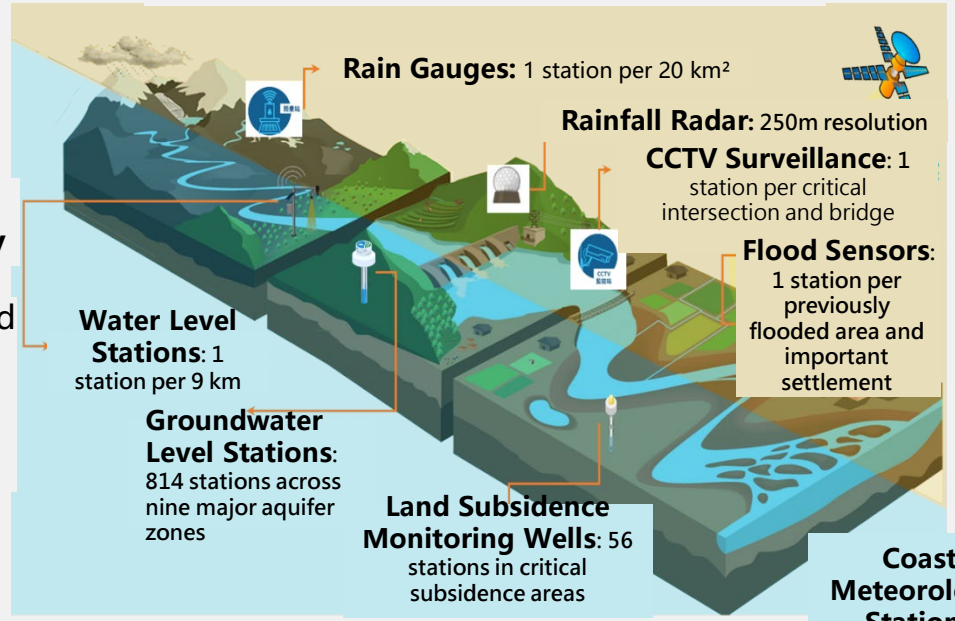


# Establishing AI Data Infrastructure Foundation Through Standardized Open Data

## Multi-Source Sensing Data Collection

### 5G Communications

Enable rapid, reliable data transmission




### Radar Technology

Provide detailed surface and atmospheric condition imagery

### Satellite Remote Sensing

Collect global monitoring data from space

### IoW Water Resources Network

Connect devices for real-time data collection and analysis

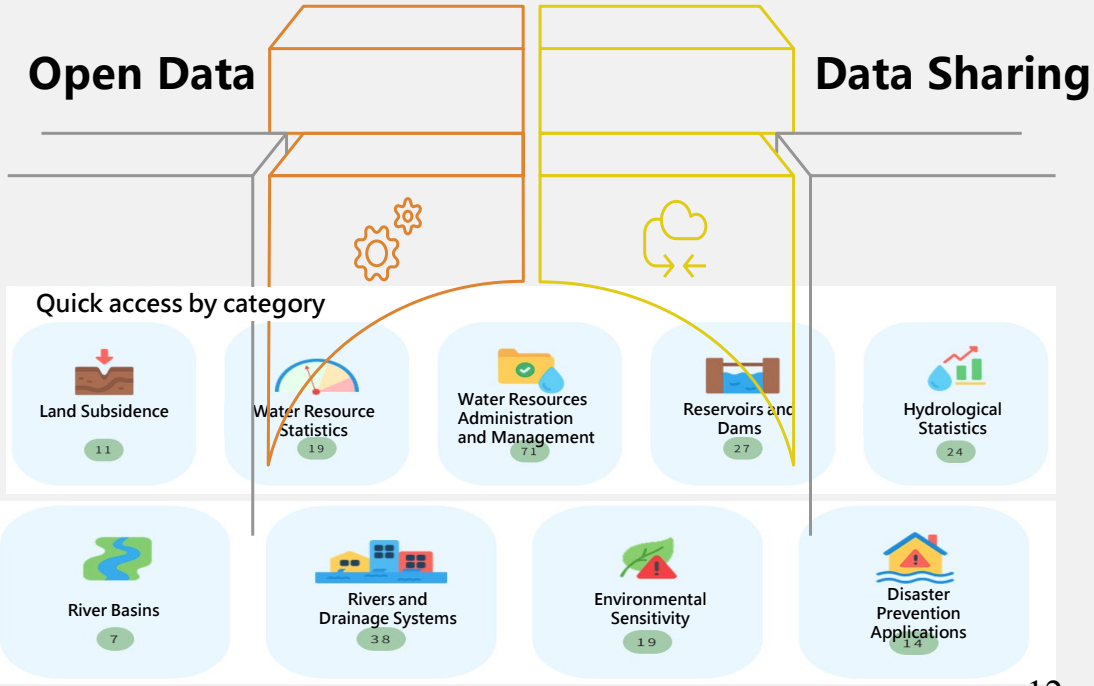
## Data Standardization

### Data Standardization

Format Standardization

### Cloud-based

Easier data access

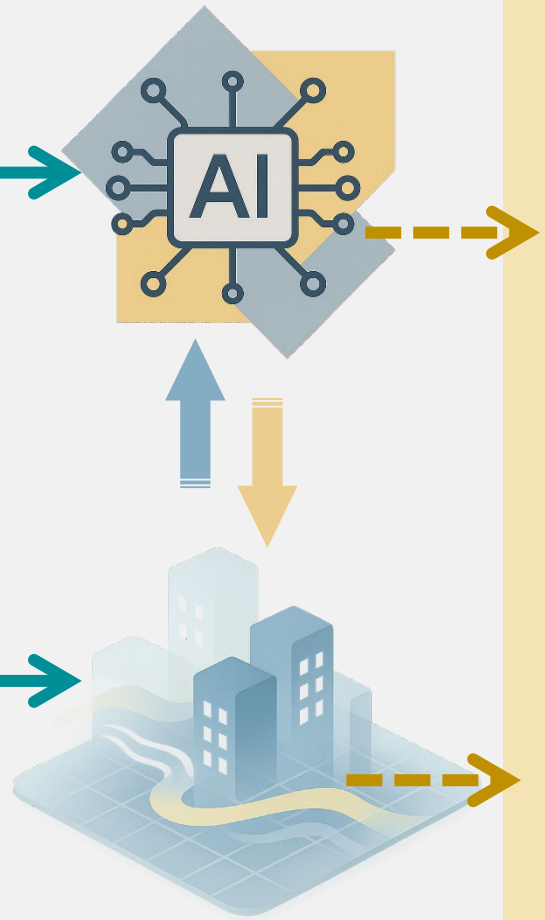


# AI Empowered Predictive Decision-Making:
## From Passive Simulation to Proactive Multi-Scenario Analysis

**Physical field observations**

**Physics-based models**

**Single simulation scenario**




**Extended computation time, delayed response**

**Multi-source data fusion**

**Deep Learning models**

**Real-time simulation and multi-scenario analysis**

### AI Deep Learning Capabilities
- Rapid Multi-Scenario Disaster Risk Assessment

### Medium- and Long-Term Drought Early Warning
- Integrate Climate and Hydrological Data for Early Resource Deployment

### Short-Term Flood Simulation
- Deploy surrogate models for real-time simulation and enhanced temporal resolution

### Decision Acceleration
- Transition from hourly-level to minute-level proactive management

**Output: Second/Minute-Level Warning Results and Decision Recommendations**

3

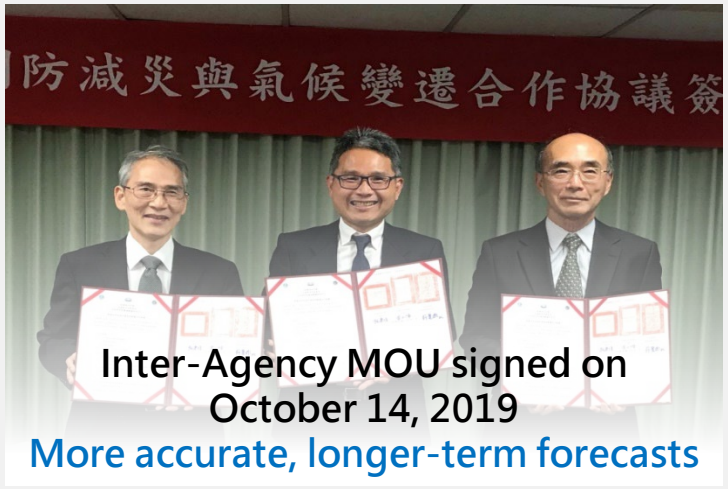
# Implementation Examples

# Strengthening Rainfall Forecasting through Meteorology–Hydrology Collaboration

## Drought

**Century-scale drought with only 880mm annual rainfall. Reservoirs across Taiwan reached historic low storage rates**

| Second Baoshan Reservoir | Liyutan Reservoir | Zengwen Reservoir on |
|---|---|---|
|  |  |  |
| Storage rate 3.82% 5/30/2021 | Storage rate 1.75% 5/30/2021 | Storage rate 3.81% 5/30/2021 |

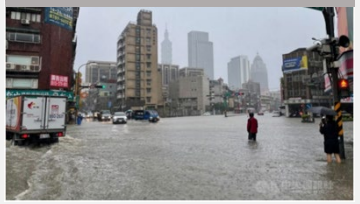




Inter-Agency MOU signed on October 14, 2019

More accurate, longer-term forecasts

## Flood

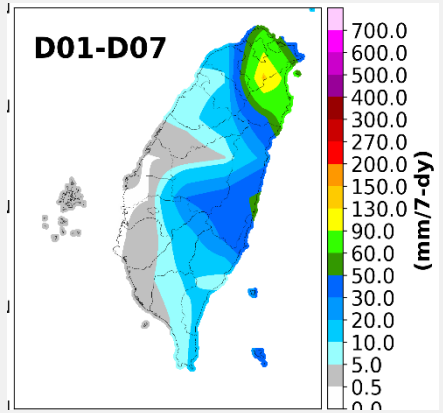
**Extreme climate with over 200 mm rainfall in one hour. Short-duration intense rainfall caused disasters in multiple locations across Taiwan**

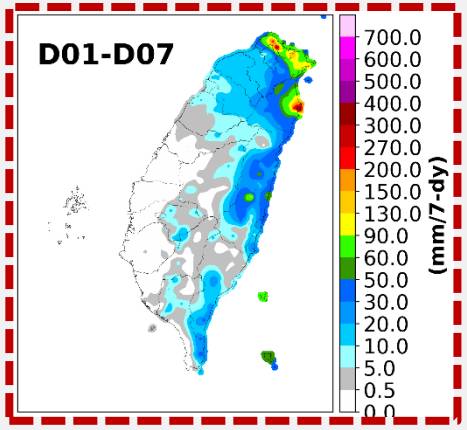
| Tainan flooding Aug. 2019 | Taipei flooding June 2021 | Yilan flooding Oct. 2022 |
|---|---|---|
|  |  |  |

| | |
|---|---|
| Increased observation stations | • Incorporated WRA reservoir catchment monitoring station data Bias correction |
| Bias correction | • Applied statistical methods for model bias correction |
| Downscaling optimization | • Utilized long-term catchment observation data to optimize downscaling forecasts |

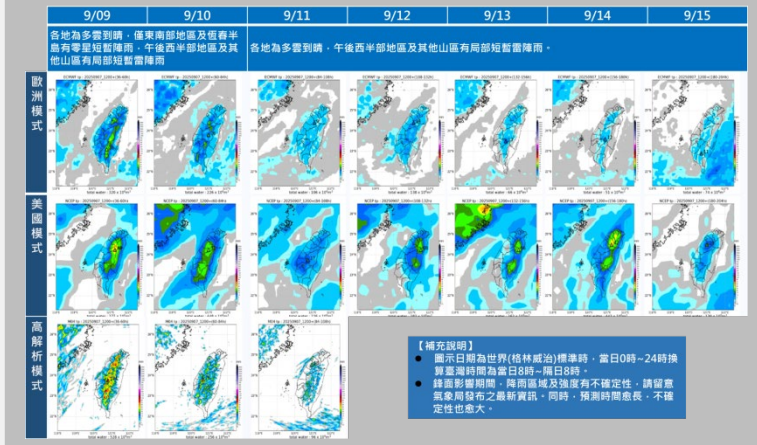
# Extended and More Accurate Meteorological Forecasts

## Improve Forecast Accuracy

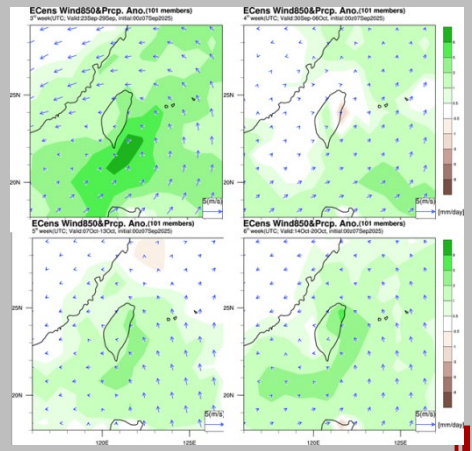


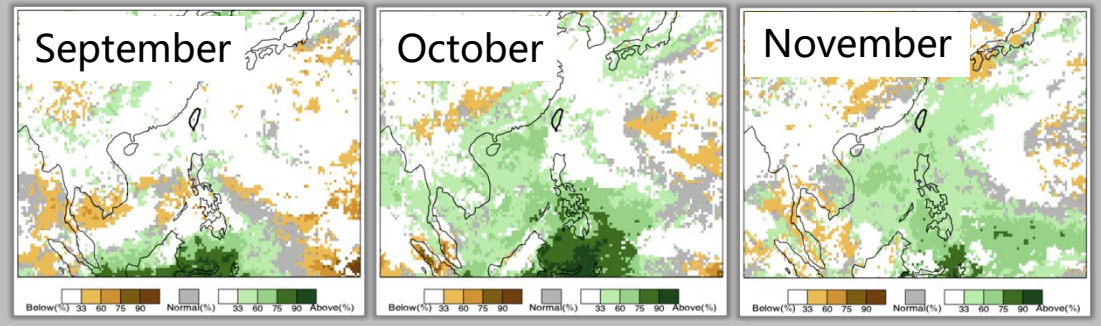

## Daily rainfall predictions




## Water availability outlook for the next 3-6 weeks




## Seasonal rainfall estimates for the coming quarter




## Extended range: 6-month rainfall prediction

## Enhanced precision: Catchment-level analysis at 1-kilometer resolution

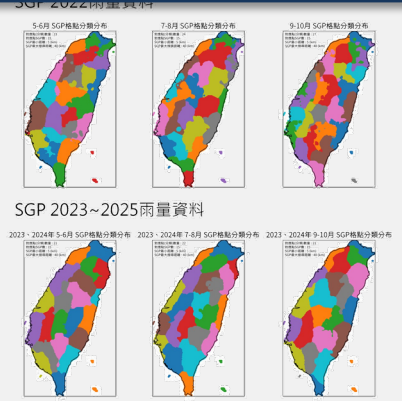
水庫集水區降雨類別預報(ECMWF_SEAS5/初始場2025年08月/reg_9gd)

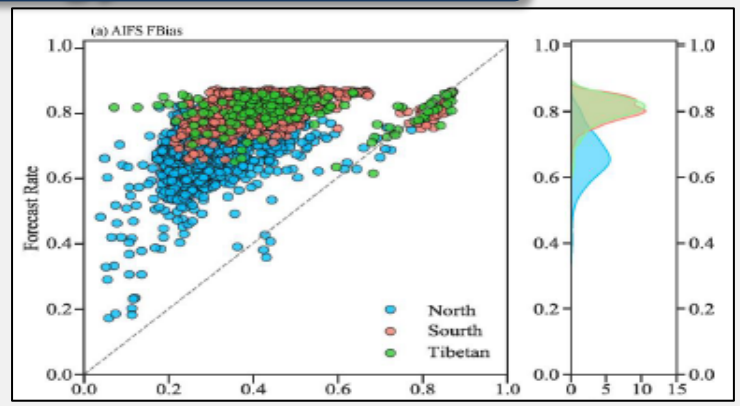
| | 8月 | 9月 | 10月 | 11月 | 12月 | 1月 | 2月 |
|---|---|---|---|---|---|---|---|
| 石門水庫 | 84.2 - 144.7 | 124.2 - 214.5 | 304.3 - 552.5 | 146.2 - 251.5 | 143.8 - 208.8 | 37.9 - 61.4 | 122.3 - 260.8 |
| 新山水庫 | 361.1 - 595 | 163.5 - 294.6 | 637.8 - 947.7 | 515 - 889.5 | 508.6 - 716.8 | 141.2 - 223.9 | 360.2 - 533.7 |
| 翡翠水庫 | 117.3 - 201.9 | 90.1 - 221.8 | 583.2 - 919.1 | 349.2 - 605.9 | 317.1 - 465.5 | 73.8 - 110.4 | 224.4 - 352.4 |
| 寶山第二水庫 | 97.1 - 165.8 | 284.7 - 707.8 | 319.2 - 823.8 | 76 - 202.9 | 1.6 - 25.3 | 5.8 - 25.3 | 140.2 - 290.2 |
| 永和山水庫 | 103.6 - 204.8 | 258.8 - 358.8 | 225.4 - 815.8 | 59.6 - 184 | 18.9 - 47.4 | 3 - 24.8 | 119.9 - 305.9 |
| 明德水庫 | 92.5 - 160.4 | 147.1 - 242.3 | 144.8 - 620.1 | 46.6 - 151.1 | 17.2 - 38.8 | 1.5 - 22.2 | 89 - 276.9 |
| 鯉魚潭水庫 | 92.5 - 188 | 113.3 - 197.3 | 53.3 - 628.4 | 27.6 - 122.3 | 11.1 - 22.7 | 0.7 - 19.9 | 54.4 - 185.1 |
| 士林攔河堰 | 84.4 - 146.1 | 158.6 - 261.9 | 268 - 965.2 | 88.3 - 223.5 | 25.4 - 61.3 | 0.4 - 24.3 | 123.2 - 296 |
| 德基水庫 | 80.3 - 123.9 | 127.6 - 205.3 | 220.7 - 497.3 | 149.3 - 268.1 | 154.2 - 204.3 | 49.6 - 89.9 | 128.2 - 308.3 |
| 石岡壩 | 88.9 - 146.1 | 107.4 - 154.3 | 136.5 - 387.6 | 110.1 - 230.6 | 126.3 - 185.4 | 17.1 - 40.8 | 109.6 - 276.4 |
| 霧社水庫 | 88.9 - 145.2 | 132 - 202.7 | 132.6 - 309.1 | 81.7 - 188.8 | 18.2 - 49.7 | 20 - 39.9 | 105.4 - 231.3 |
| 日月潭水庫 | 95.8 - 150.7 | 155.2 - 257.3 | 129.4 - 312 | 84.3 - 176.6 | 18.4 - 45.4 | 25.2 - 58.2 | 97.3 - 189 |
| 集集攔河堰 | 123.9 - 187.4 | 159.6 - 179.8 | 118.3 - 339.1 | 52.6 - 90 | 13.9 - 39.3 | 14.1 - 39.6 | 69.9 - 109 |
| 湖山水庫 | 236.5 - 335.1 | 225.7 - 365.4 | 168.2 - 1151 | 48.6 - 123 | 66.8 - 102.7 | 19.6 - 39.9 | 95.4 - 104.8 |
| 仁義潭水庫 | 287 - 432.7 | 394.8 - 955.7 | 164 - 1154.3 | 34.2 - 87.9 | 49.3 - 77.8 | 4 - 14.7 | 42.2 - 83.2 |
| 白河水庫 | 376.3 - 454.5 | 405.1 - 976.8 | 180.2 - 599.2 | 34 - 82.5 | 21.9 - 37.8 | 17.8 - 37.3 | 31.8 - 63.1 |
| 烏山頭水庫 | 269.1 - 374.2 | 308.4 - 824.6 | 134.5 - 486.2 | 23.5 - 56.9 | 0 - 1.1 | 18 - 49.8 | 20.6 - 40.7 |
| 曾文水庫 | 250 - 378.2 | 391.5 - 952.8 | 197.9 - 1151 | 45.6 - 94.1 | 56.1 - 94.8 | 4.1 - 15 | 44.9 - 94.3 |
| 南化水庫 | 272.3 - 391.2 | 365.5 - 913.1 | 187 - 647.3 | 28.3 - 67.7 | 1.4 - 9.8 | 13.5 - 29.5 | 23.2 - 47.8 |
| 阿公店水庫 | 184.1 - 297.2 | 319.3 - 804.3 | 74.1 - 120.4 | 29.3 - 52.3 | 0.5 - 4.1 | 4.8 - 11.3 | 0 - 0 |
| 高屏溪攔河堰 | 211.8 - 359.1 | 291 - 803.1 | 155.4 - 348.1 | 59.8 - 123.6 | 13.9 - 30.4 | 2.1 - 10.4 | 32.8 - 71.1 |
| 甲仙攔河堰 | 211.2 - 304.9 | 392.3 - 846.6 | 91.9 - 132.7 | 62.9 - 119.6 | 65.8 - 118.2 | 16.6 - 29.5 | 47.1 - 103.9 |
| 牡丹水庫 | 248.5 - 390.9 | 388.9 - 843.3 | 275.1 - 664.8 | 307 - 611.8 | 96.2 - 157.7 | 25.1 - 42.1 | 84.7 - 129.2 |

預報類別 EP10 EP10-30 EP30-50 EP50-70 EP70-90 EP90

# High-Resolution, Multi-Model Rainfall Forecasting Technology Advancement

## Forecast technology advancement




**Increased historical data training length** and analyzed the impact of different data lengths on SGP, QM, and DW calculation results

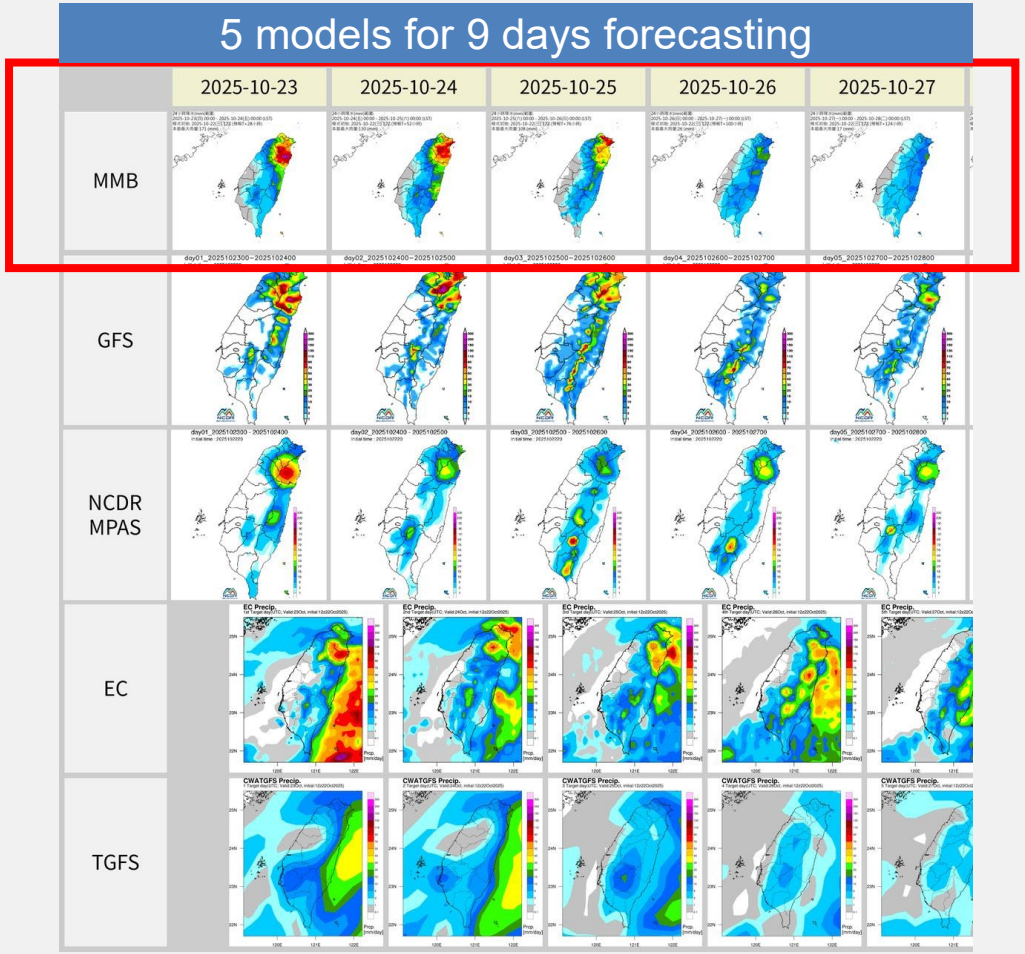
**Added European Centre for Medium-Range Weather Forecasts AI model (ECMWF-AIFS)**

- Time resolution: 6 hours
- Horizontal resolution: 25 kilometers
- Forecast lead time: 360 hours (12 days)

ECMWF AI model demonstrated high accuracy

Island-wide gridded forecasting with target resolution of 2 kilometers

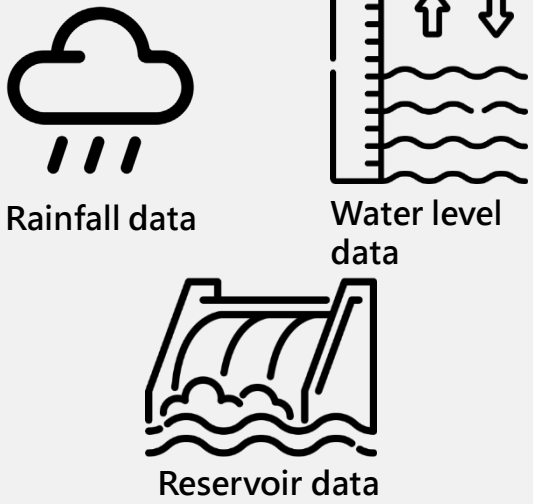
## Outputs are provided daily with other forecast models



# Continue Developing Flood forecasting by Integrating AI Technology

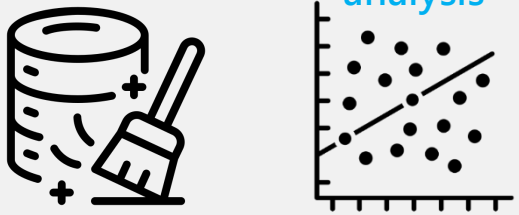
## 1. Collect hydrological data and watershed-related information

### Data collection

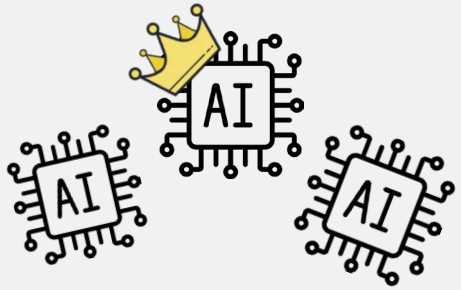


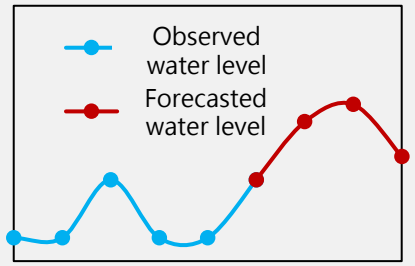

Data preprocessing

Correlation analysis



## 2. Establish AI flood forecasting models for Zhuoshui, Zengwen, and Bajhang Rivers




Establish and compare 3 AI model flood forecasts

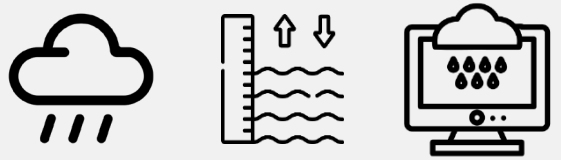
Perform parameter sensitivity analysis on the optimal model

AI flood forecasting model database

## 3. AI flood forecasting results deployed online

Updated every 10 minutes

Interface with real-time data



Rainfall observations

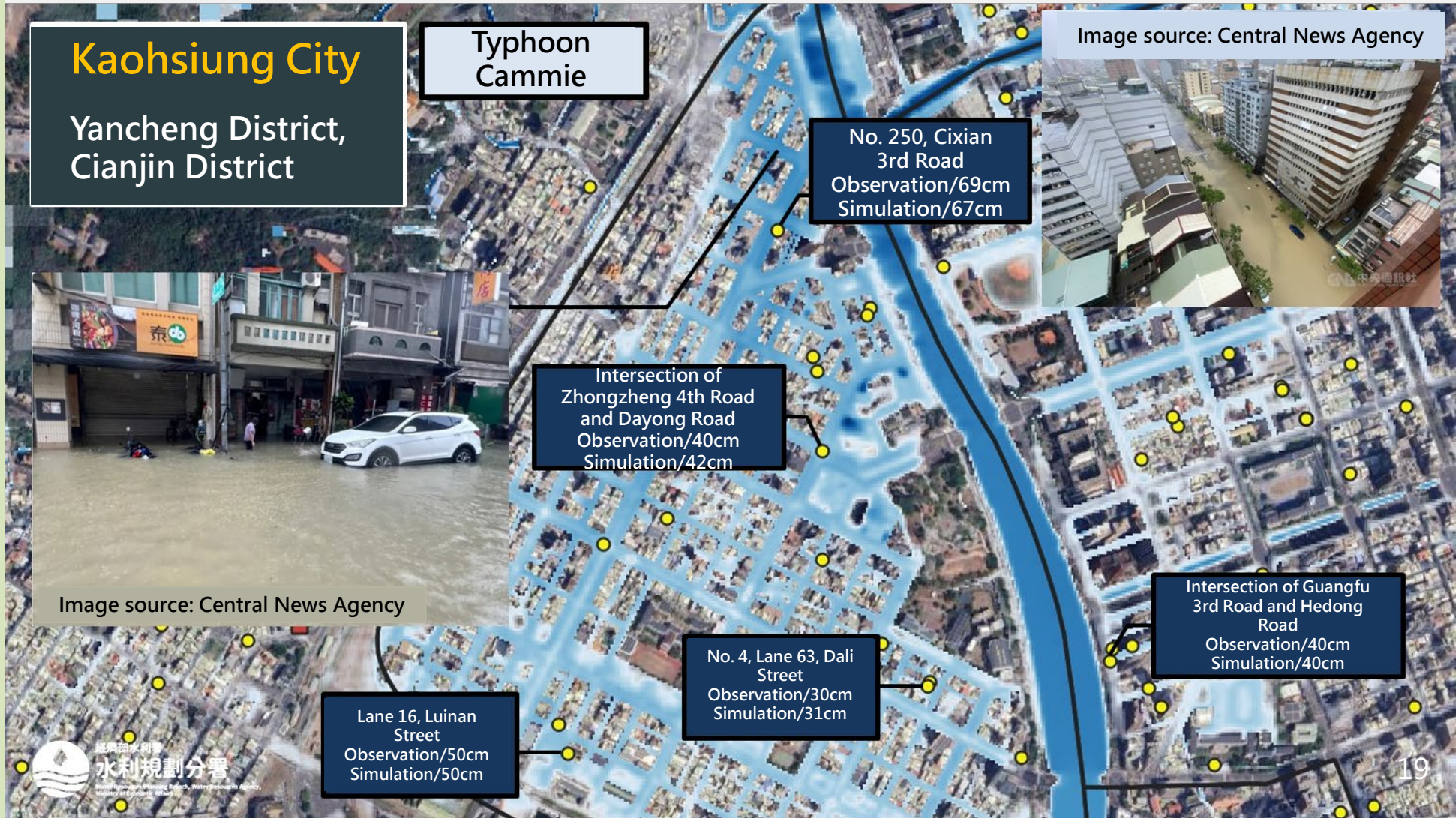
River water level

Rainfall forecasts

AI model forecasts river water level for the next 3-4 hours

# Fourth-Generation Flooding Potential Maps Incorporating Fine-Scale Digital Elevation Models and Parallel Computing

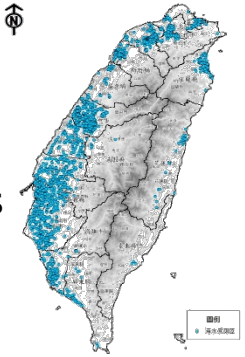
- ✓ 4th-Gen flooding potential maps released 10 quantitative rainfall scenarios for with both static and dynamic mapping resources to support each unit's disaster prevention and response decision-making.
- ✓ Through enhanced AI computing power and large-scale event simulation, flood early warning capability can be improved.
- ✓ Expected to combine with digital mapping to alert road users for detours and assist residents in installing flood barriers.



# AI Image Recognition to Capture Flood Disaster Information for Real-Time Emergency Response

- ✓ Grasp flood situation, river water level height, issue real-time alerts, secure rescue operation window, prevent disaster escalation.
- ✓ Alert construction personnel and equipment to evacuate, safeguard lives and property.

## 01



Deploy 2,055 flood sensors

Interface over 9,000 camera feeds and 800 vehicle-mounted cameras

API

Water situation image online platform

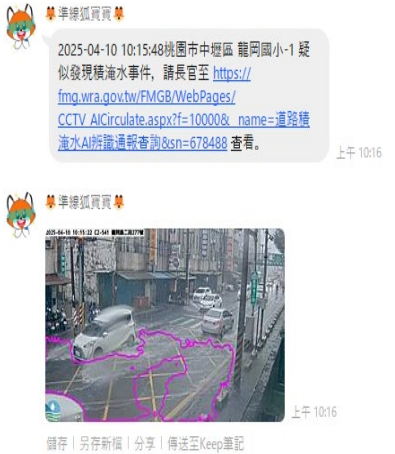
## 02

Road ponding and flooding image recognition

Personnel, equipment, and water level image recognition


## 03

Support emergency duty rotation and notification identification




Flood Reporting via Messaging App

# AI Image Recognition and Object Detection
## Intelligent Monitoring Model for River Area and Engineering Quality Management

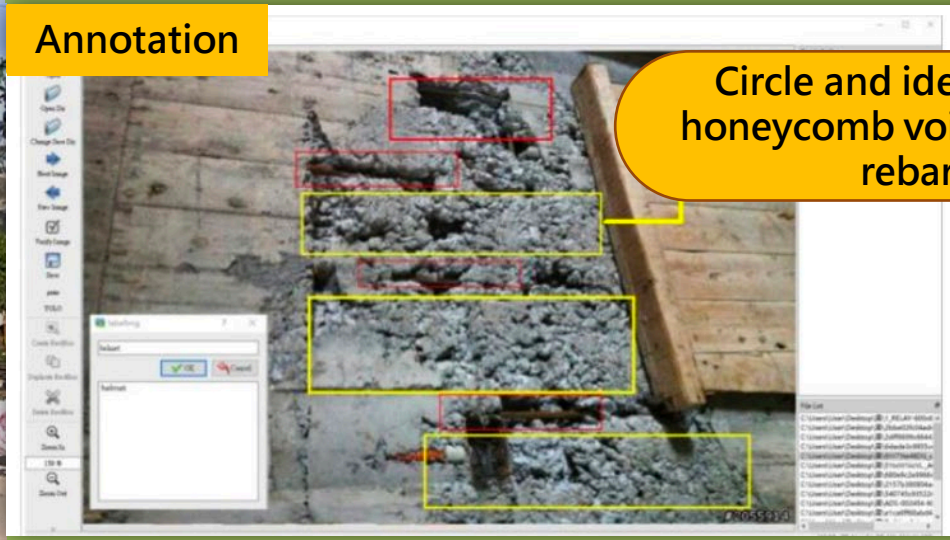
## YOLO Image Recognition

- ✓ Pre-filter out lighting, animals, and other non-primary target events.
- ✓ Identify vehicles, motorcycles carrying goods, and item. carried by personnel
- ✓ After image category detection, provide to LLM for analysis.


YOLO initial image screening, marking potential events

## AI Object Detection

Annotation



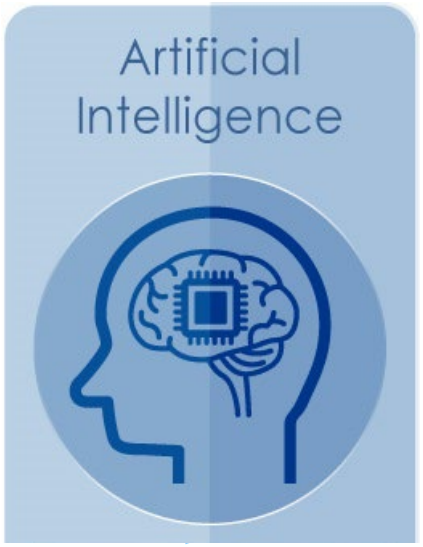

Integrated recognition of concrete surface rebar exposure and honeycomb voids

**AI dual-layer filtering**
Human verification event volume significantly reduced by **80%**

**Recognition accuracy reaches 85%**

# 4 Conclusion

# AI Innovation for a New Vision of Smart Water Management



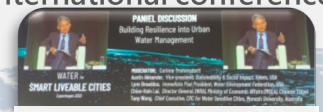


**Integrated Watershed Management**

- **Enhance Early Warning Precision**
- **Real-Time Disaster Response**
- **Improve Operation Efficiency**
- **Support Allocation Decision-Making**

# Build Global Smart Water Management Partnerships Taiwan Can Help!

Taiwan water resources technology showcase at international conferences

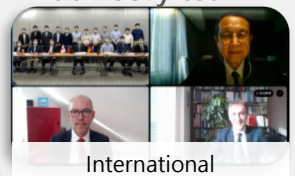


IWA World Water Congress

Subsurface exploration technology exchange

The Trade Council of Denmark, Taipei

WRA international advisory team



International consultant expert roundtable discussions

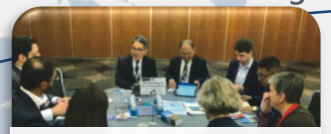
APEC Water resources infrastructure exchange

APEC Infrastructure Senior Officials Meeting

Comprehensive water resources management technical cooperation agreement

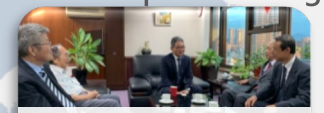
U.S. Army Corps of Engineers

Water resources future trend exchange



UK Global Water Leaders Summit

Taiwan-Japan exchange

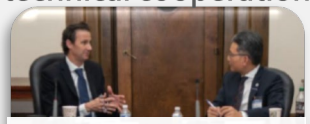


Japan River Improvement Research Institute

Taiwan-Netherlands Working Group platform


Netherlands Office Taipei

Taiwan-U.S. water resources technical cooperation



U.S. Bureau of Reclamation

Honduras Ambassador visit to WRA

Honduras Water Resources Development Exchange

Water industry exchange

Former Thai Senator visit to WRA


Taiwan-Japan Engineering Technology Seminar

South African Parliamentary members visit to WRA

Water resources management exchange

Singapore Public Utilities Board (PUB) visit to WRA

Water resources technology exchange

Taiwan-Indonesia reservoir cooperation

Reservoir desilting technology exchange

# Constructing a value chain of smart water industry

## For the next generation

~Water conservancy is an ancient industry~

~Leveraging AI to unlock new value in water industry~



Intelligent Transformation
AI-Driven Innovation for Smarter, Sustainable Water Resources
Sustainable Development

TAIWAN INT'L WATER WEEK

# Smart Watershed, AI-Driven Innovation

# 智慧流域 AI領航

International Forum 2025

# Intelligence in Motion

## Building Resilient Systems for an Uncertain World

### TIWW – 2025

**28th October 2025**

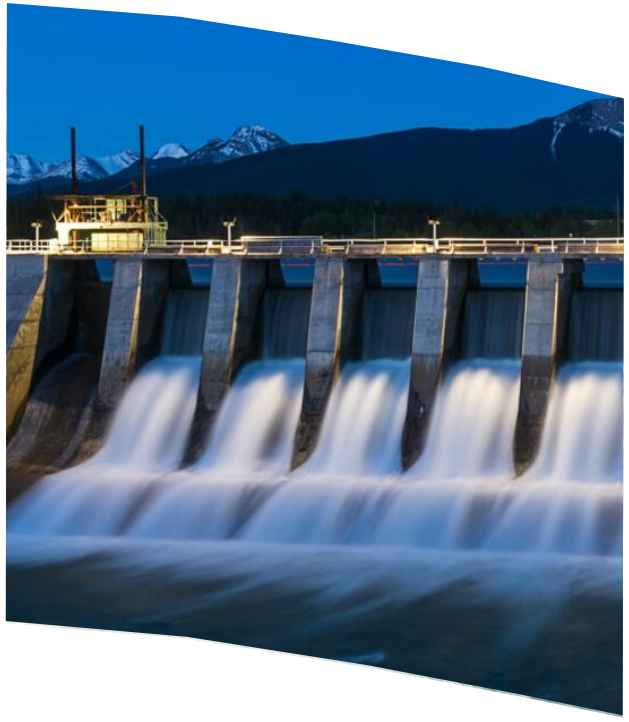
**Kala Vairavamoorthy, CEO, IWA**

the international water association

inspiring change

# the weight water carries

farming on fragile flows



no water, no power

urban thirst rising

too little, too much, too sick

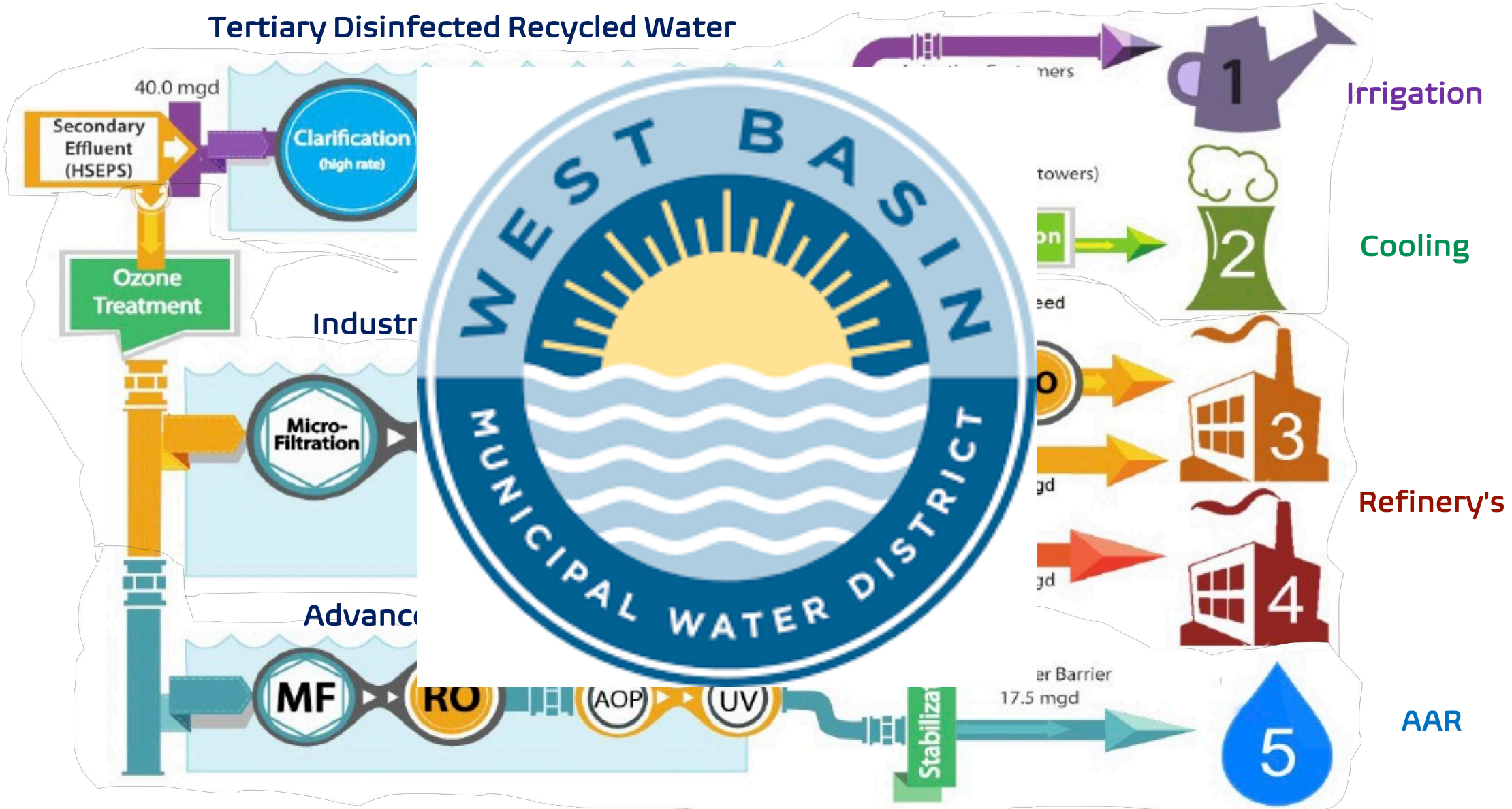
# water is a solution....because it’s a victim

every drop reused

green works harder

flood-ready futures

# designer waters, waters of different flavours



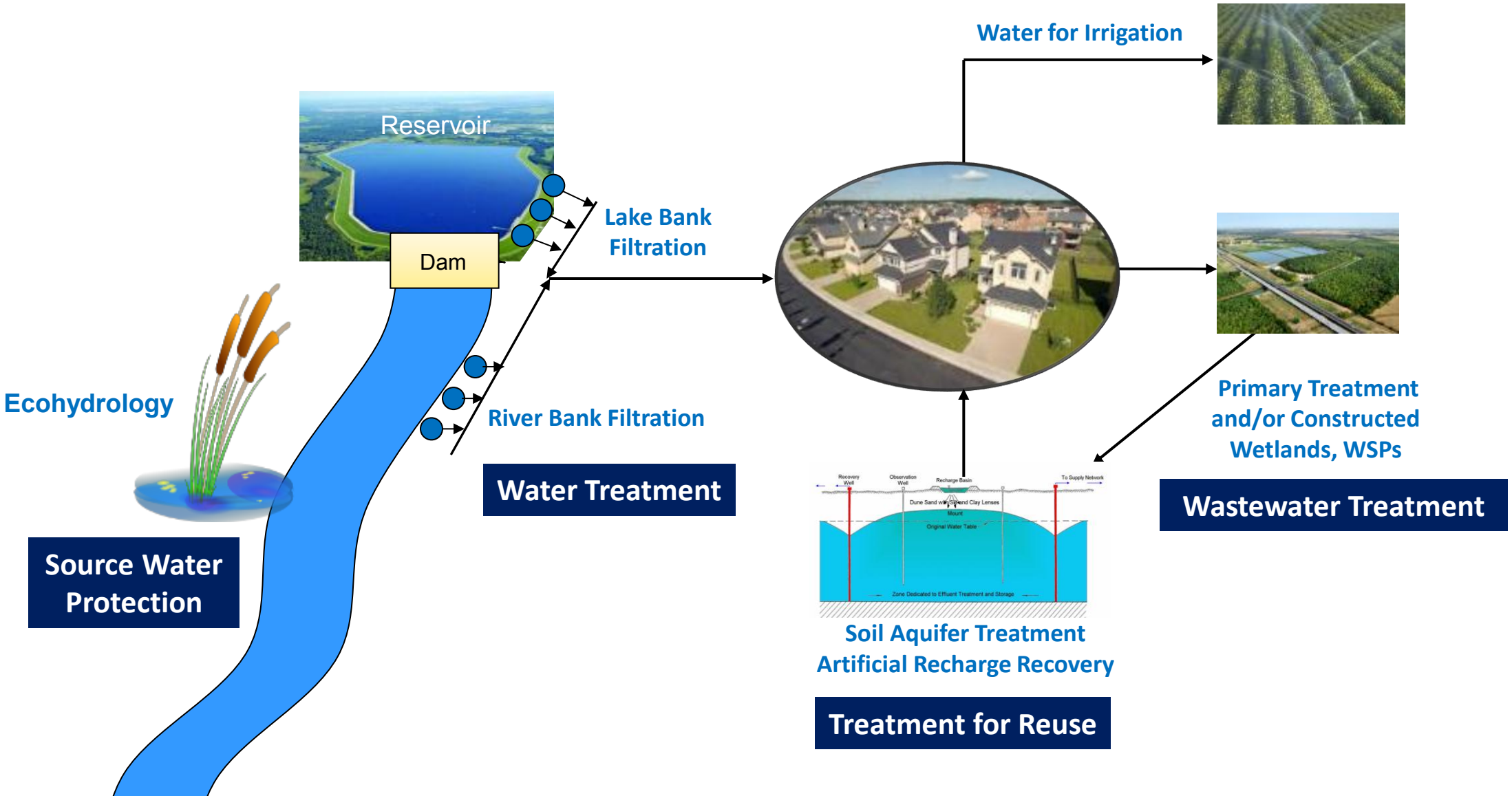
# integrated portfolios build resilience


Chennai, India – *6 kudams*


Singapore, 4 National Taps

# nature-based solutions

## closing the loop, boosting resilience



# modular NbS: building blocks for living cities

eco-treatment

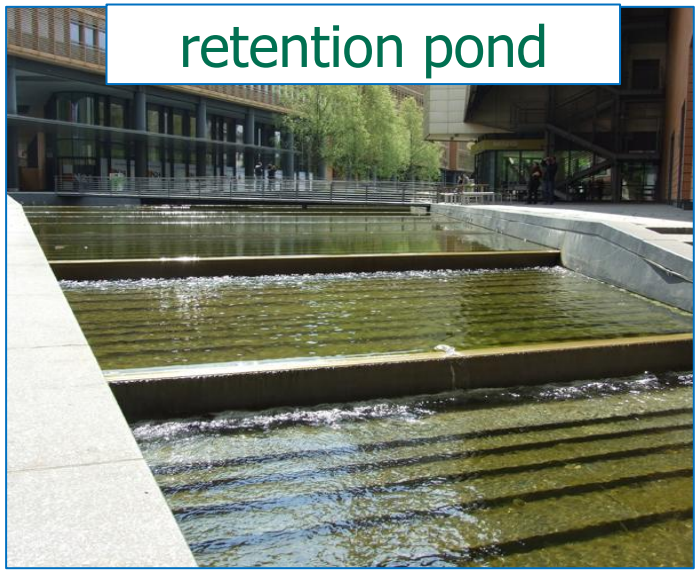
green roofs

pervious pavement

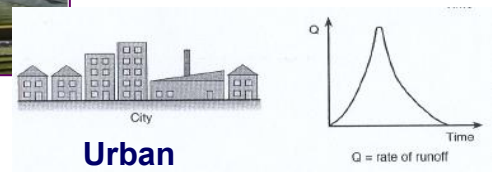
infiltration trench

tree filters

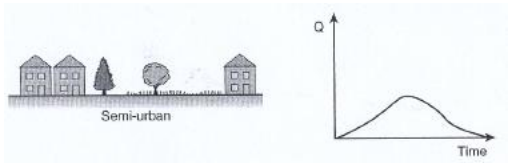
retention pond



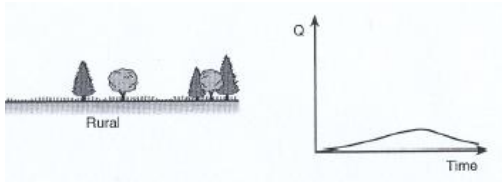
# adaptive - designing within the uncertainty envelope



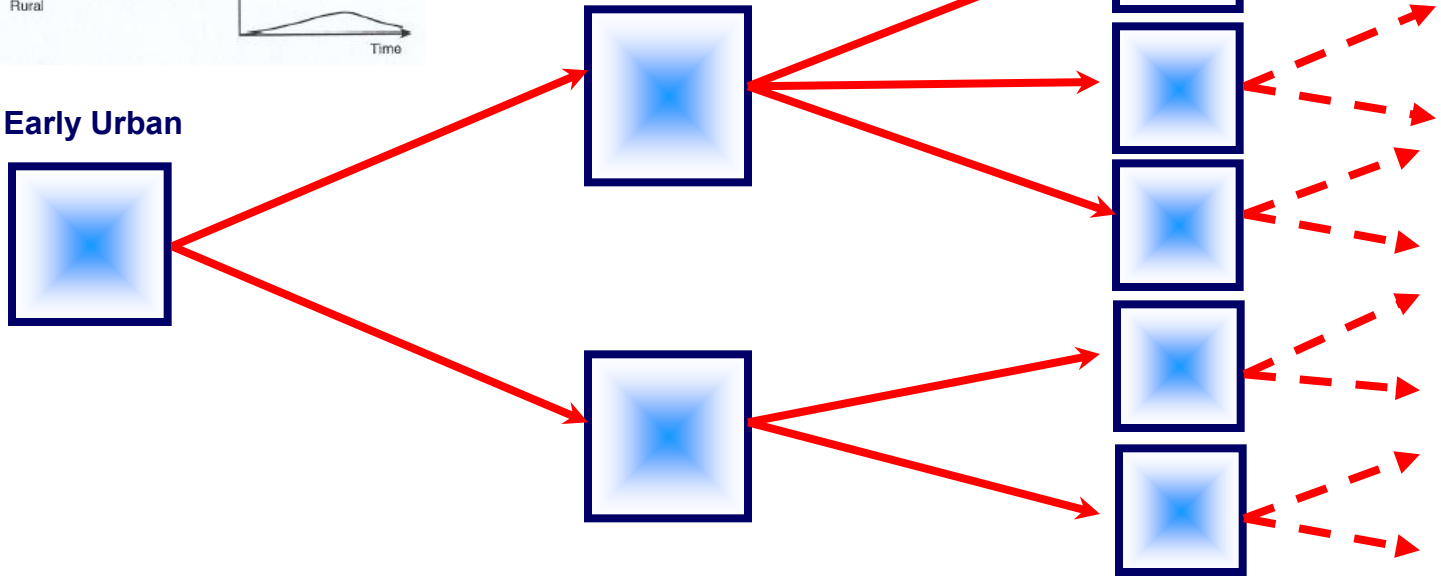

Urban




Urbanization



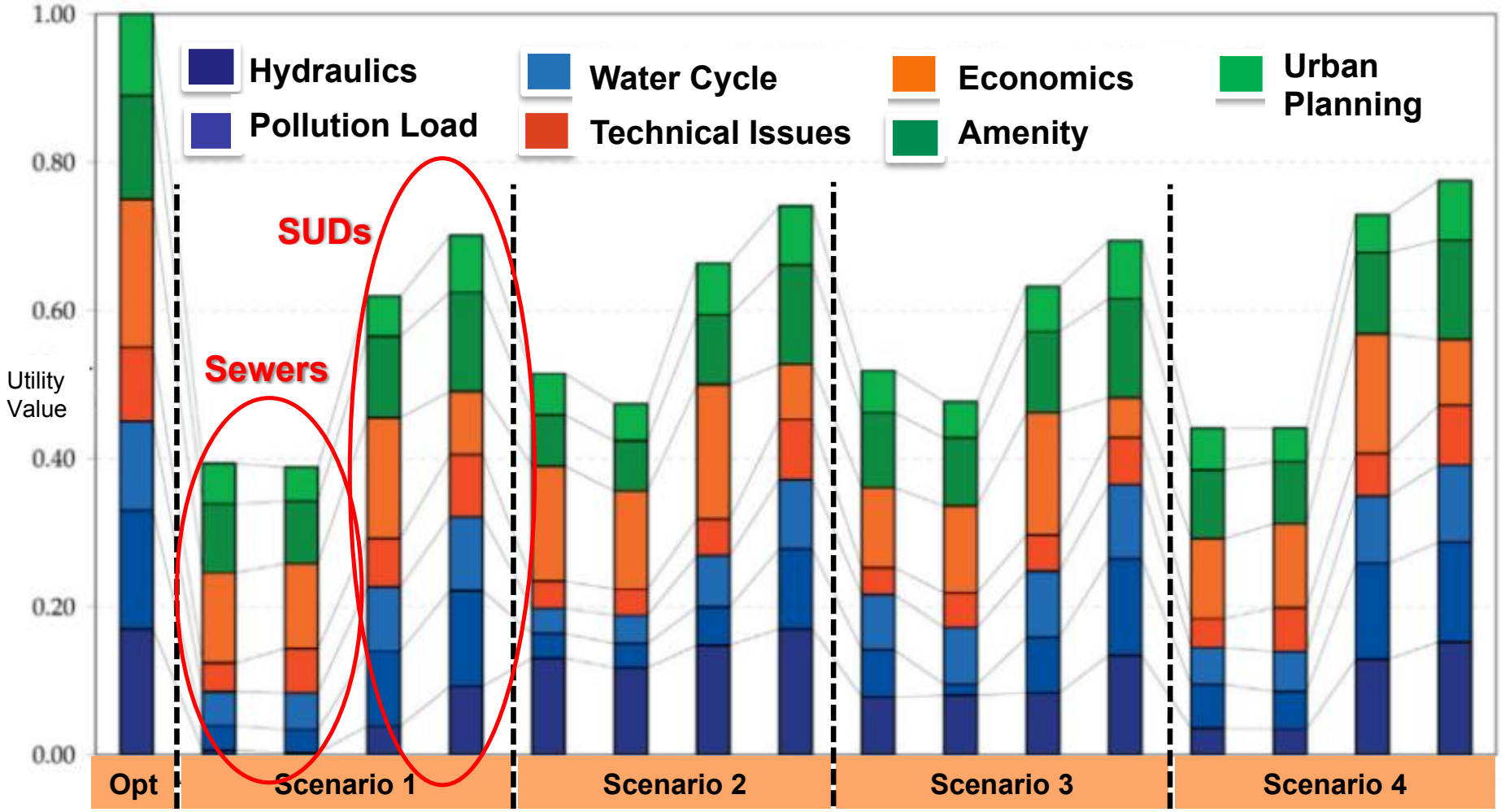

Early Urban



Time

# performance in practice: why modularity works

## Case Study: Kupferzell Germany



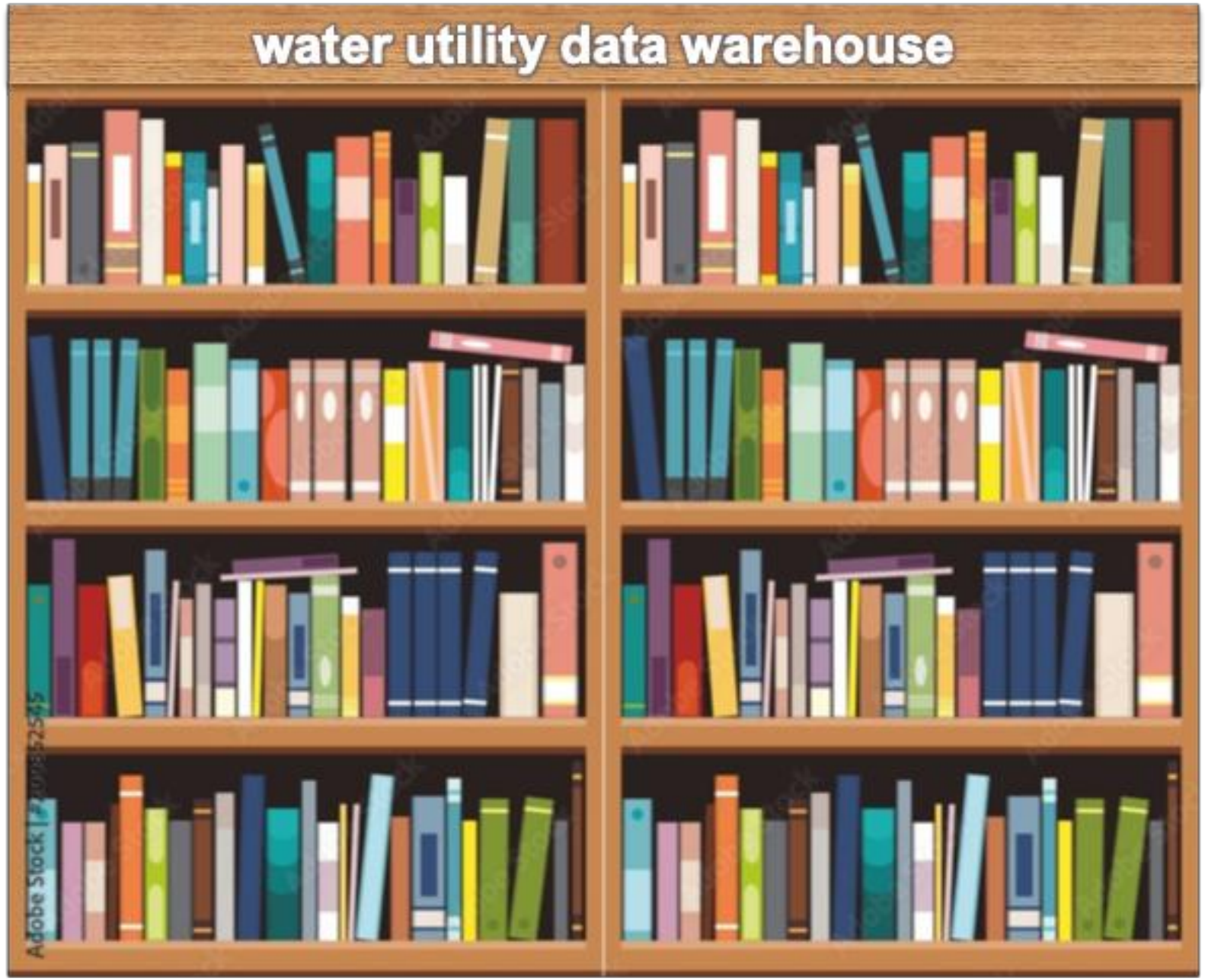

Eckart, Sieker, Vairavamoorthy (2010)

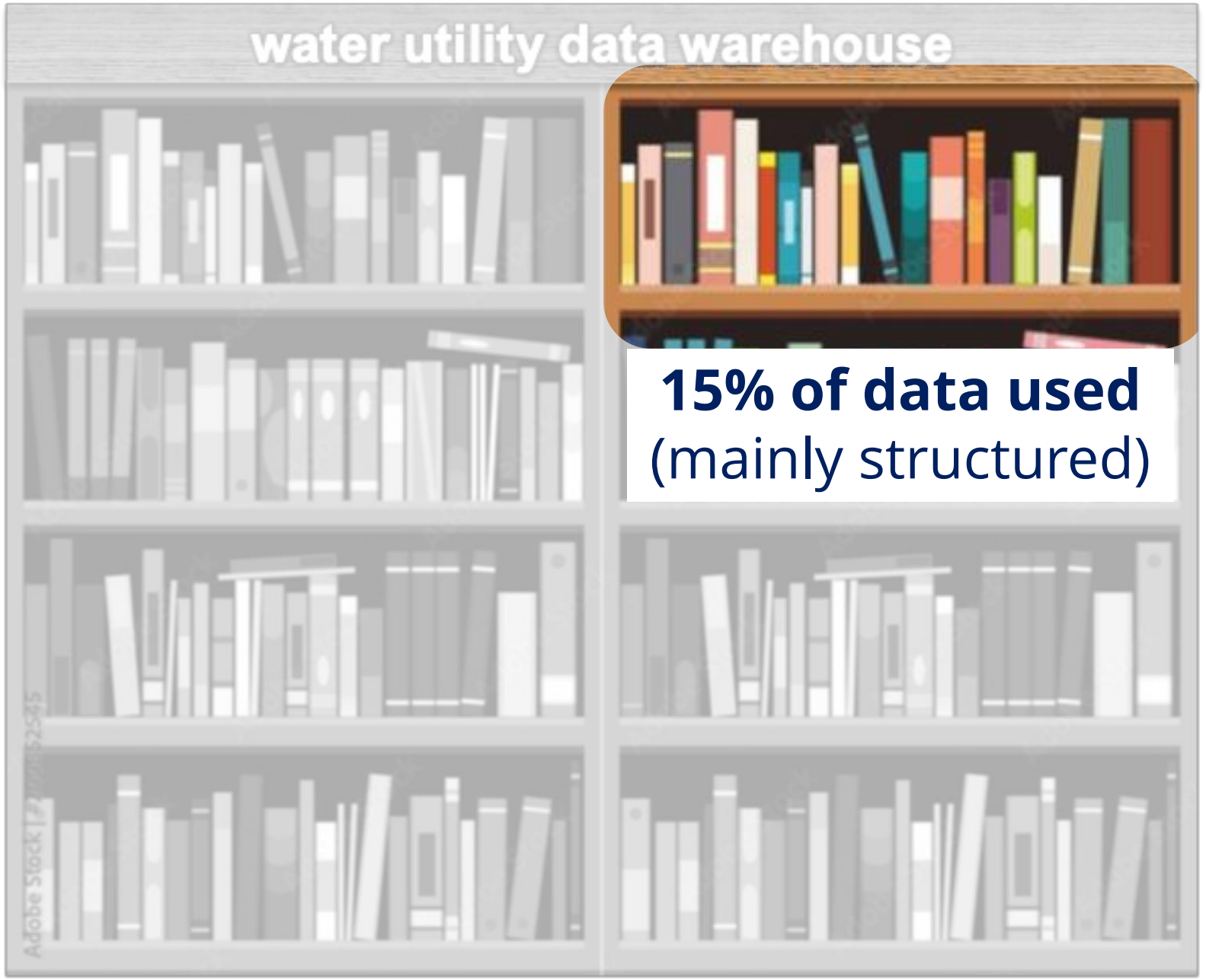
# unleashing the power of generative AI

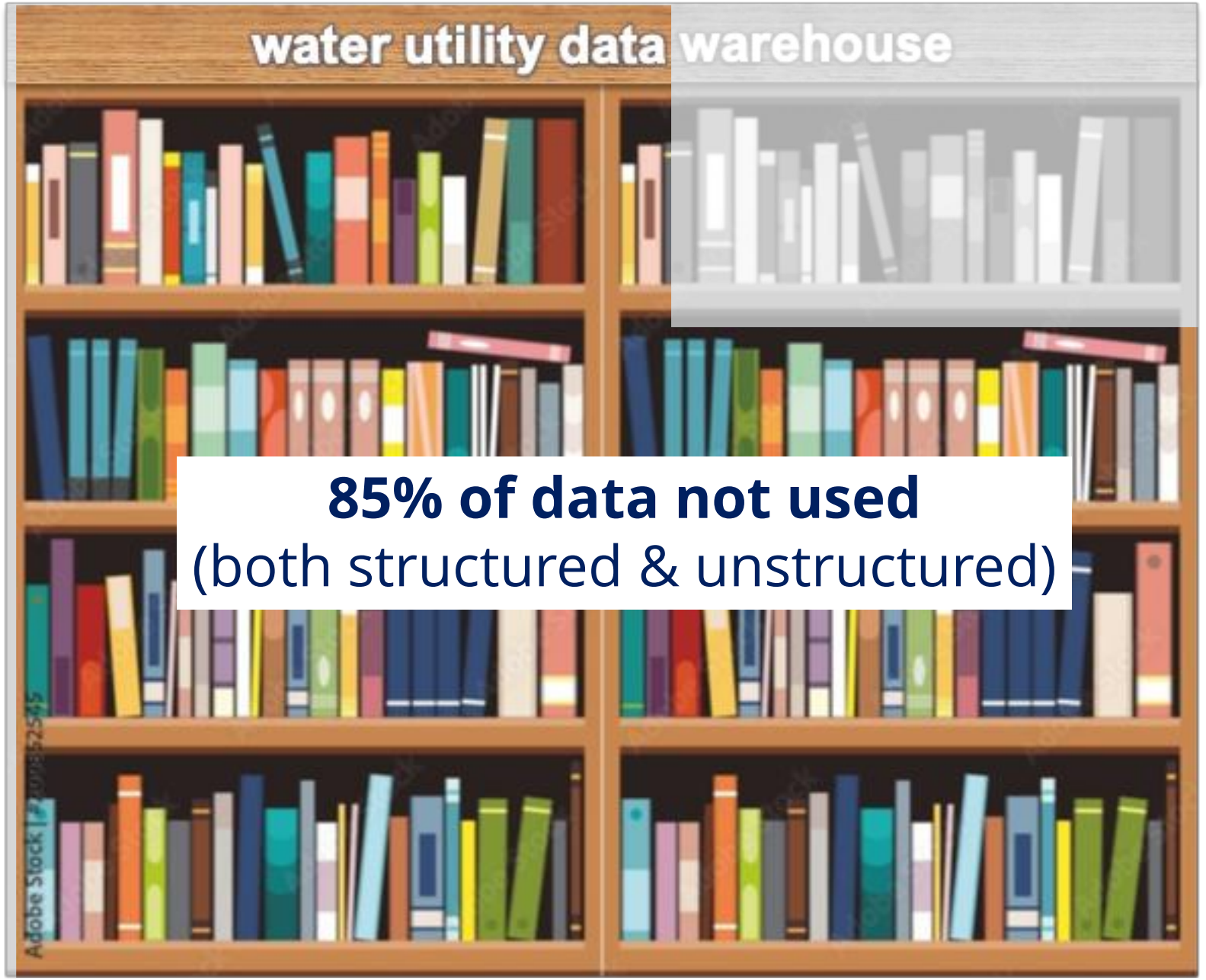
## unlocking hidden insights across all our water systems

from complexity to clarity: integrating structured, unstructured, and tacit data


SEVEN SQUARE

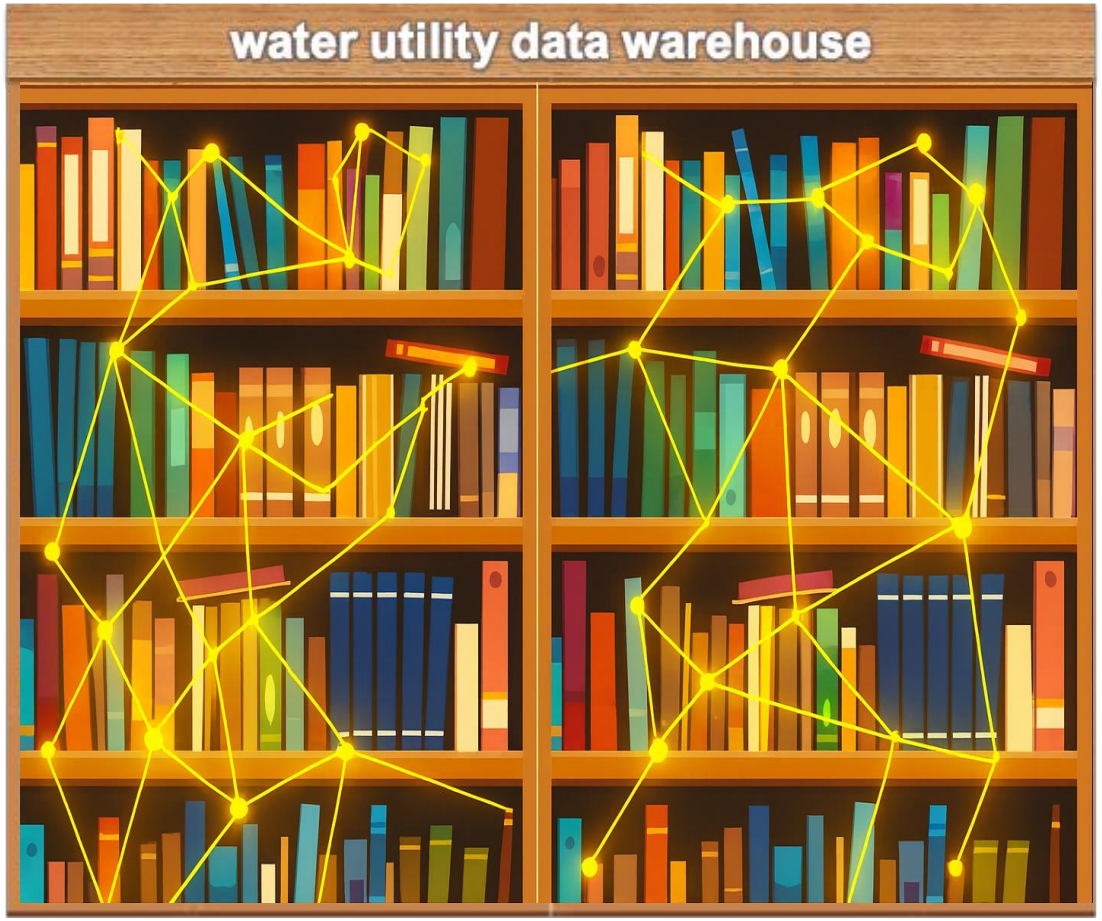

water utility data warehouse
Adobe Stock | #


water utility data warehouse
15% of data used
(mainly structured)


water utility data warehouse
85% of data not used
(both structured & unstructured)

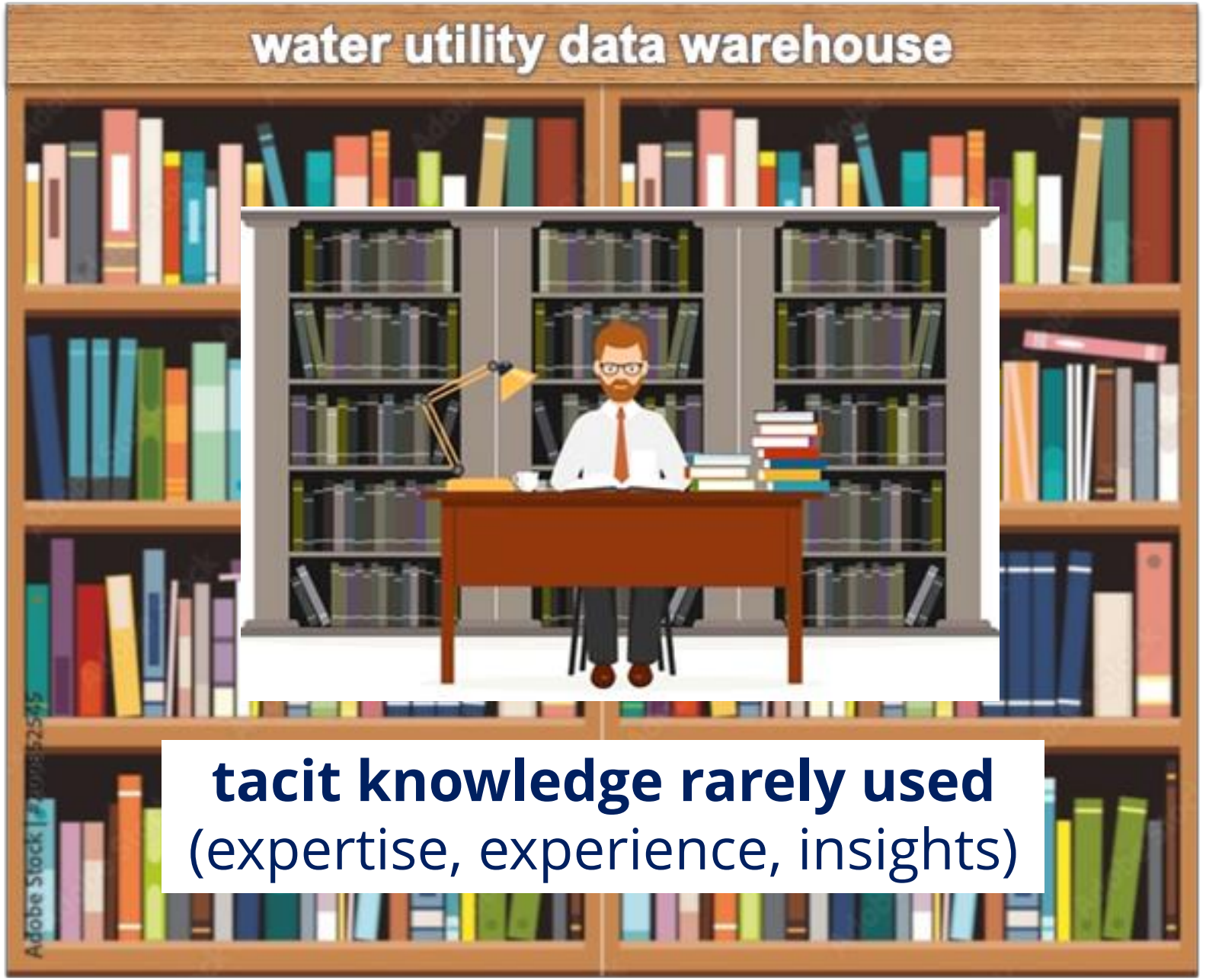
# from data blindness to data brilliance

## Connected Data

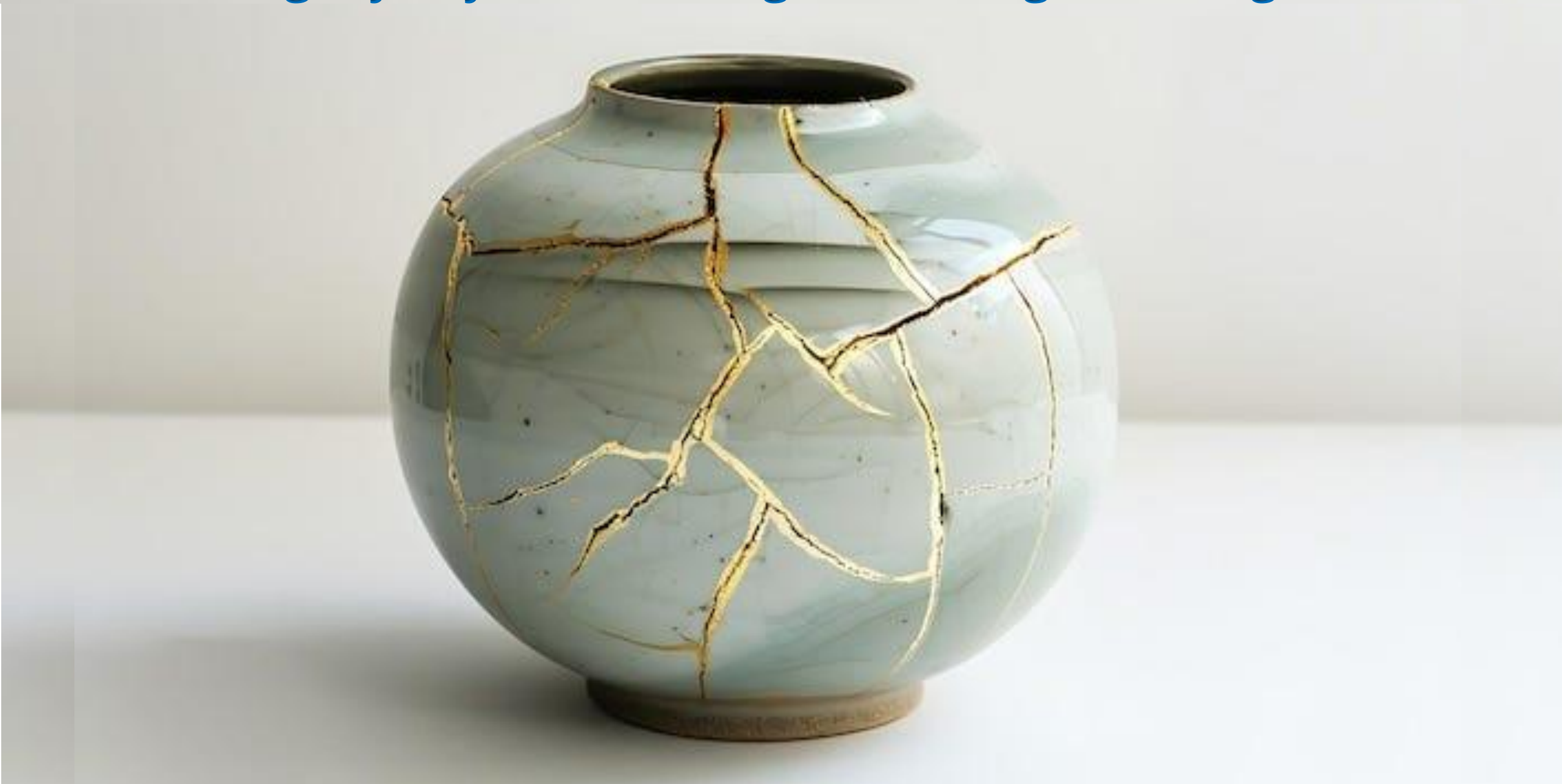



## Empowered People

**RAG** links the fragments of our knowledge so everyone - from control room to boardroom - can ask better questions and make smarter decisions


water utility data warehouse
tacit knowledge rarely used
(expertise, experience, insights)

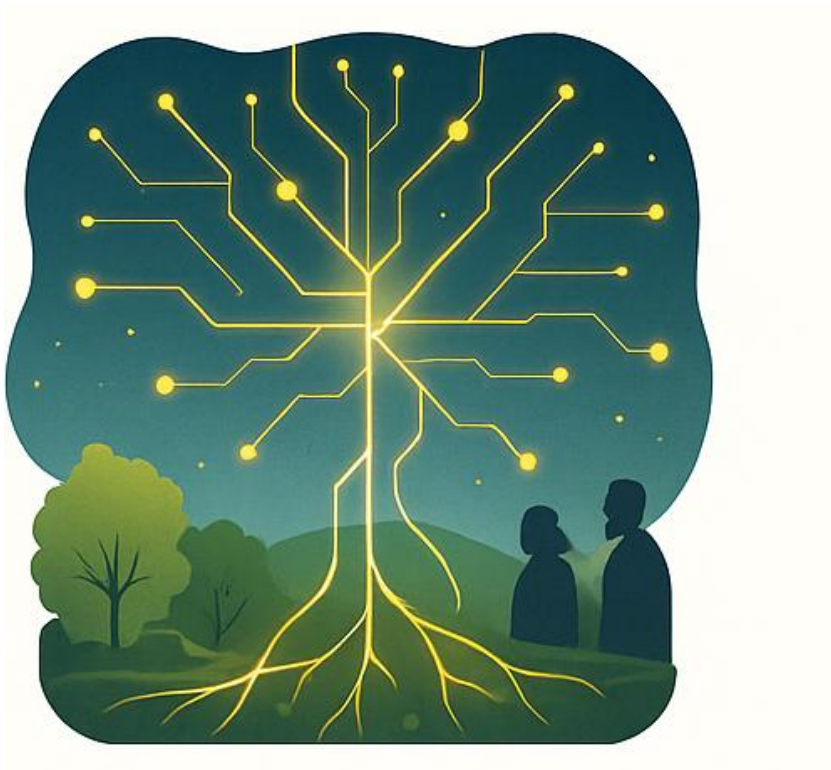
# anti-fragility - systems that grow stronger through stress



# from monitoring to conversing

## how generative AI helps us manage nature-based systems

**living resilience**



**intelligent resilience**

bridges people, nature & data - helping living systems learn, grow stronger through change

# from monitoring to conversing
## how generative AI helps us manage nature-based systems

- **Unify every lens on the landscape —** bringing together field notes, community observations, and ecological data into one shared view
- **Interpret complex change —** linking rainfall, vegetation, and land-use dynamics to reveal how ecosystems adapt under pressure
- **Connect human and machine sensing —** aligning satellite data with local observations to create a living feedback loop.
- **Co-design with nature —** generating adaptive design options that evolve with climate, hydrology, and ecology

# from prediction to preparation

## generative AI and water reuse – intelligence in motion


physical systems that don’t resist change but learn from it

# from prediction to preparation
## generative AI and water reuse – intelligence in motion

- **Unify complexity in real time** — connect quality, weather, energy, and demand data across reuse systems.
- **Simulate and stress-test dynamically** — explore “what if” drought or demand surge scenarios before they happen.
- **Learn through disturbance** — turn every flood, failure, or fluctuation into intelligence that strengthens the next response.
- **Evolve continuously** — transform reuse systems from fixed plans to living, adaptive networks.

# choices before us