UK WATER PARTNERSHIP

Water Resilience Showcase

28 June 2023
30 June 2023

THE UK WATER PARTNERSHIP

Department for Business & Trade

Programme – 30/06/23

Red Room

0	07:00	-	07:20	Welcome and Introduction
1	07:25	-	07:40	Planning for resilience
2	07:45	-	08:00	Planning for resilience
3	08:05	-	08:20	Flood Management
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Blue Room

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Department for Business & Trade

Welcome

Hans Jensen
Director
The UK Water Partnership

Stephanie Martin
Water Sector Manager
UK Department for
Business and Trade

Martin Shouler
Arup
Water Resilience co-Leader
The UK Water Partnership

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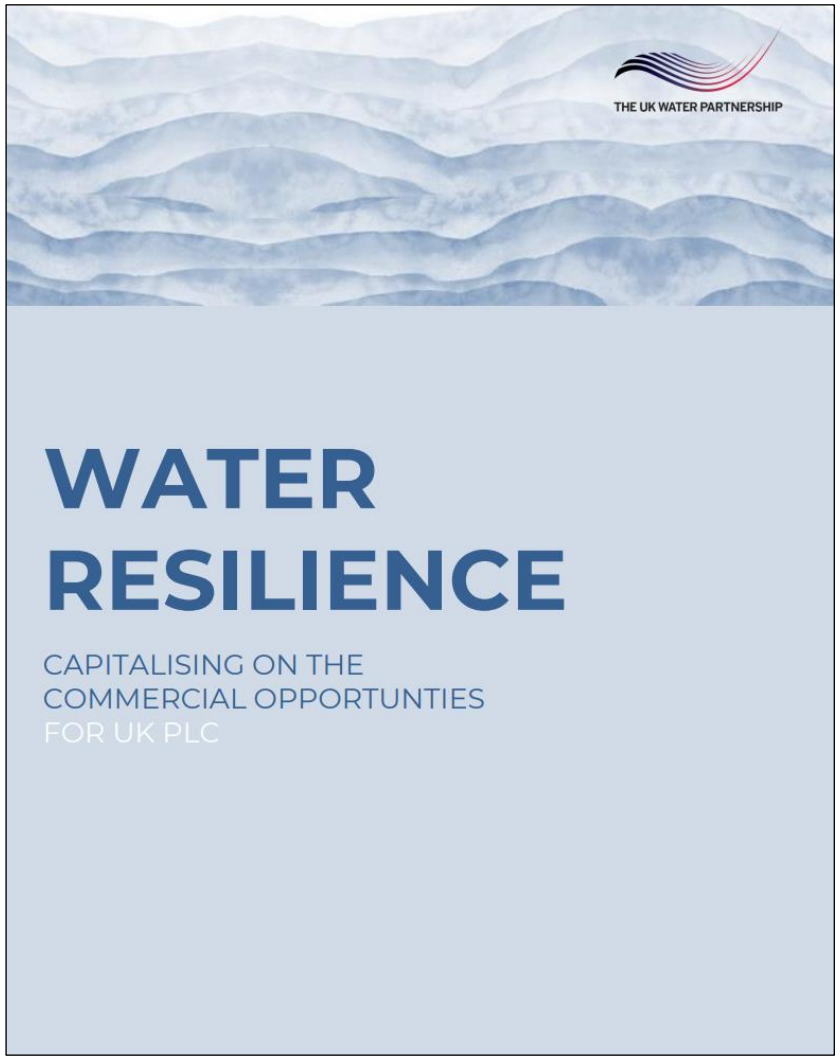
Business & Trade



THE UK WATER PARTNERSHIP ARUP

UK Water Resilience Showcase

Martin Shouler

The Global Challenge

1 in 4

large cities are already facing water stress

Global water consumption has

doubled every 20 years.

That's twice the rate of population growth.[11]

+55%

Water demand increase by 2050

Lost water through leaks or unbilled usage in 2013:

30%

Average American city

~53%

New Delhi

38%

Most developing nations

Many Pacific Island nations are

less than 5m above sea level

thousands of inhabitants are at risk

By 2030, If efficiency does not improve, worldwide water demand will outstrip supply by[10]

40%

It is estimated that between

1.6 and 2.4 billion

people live in river basins that experience water scarcity.[4]

3.2 million m^3

The amount of water the 100 largest cities in the world transfer approximately 5,700km through artificial channels per day.[2]

1

Defining Urban Water Resilience

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WE DEFINE WATER RESILIENCE AS:

Providing access to high quality water resources for all residents.

Providing sanitation to protect public health.

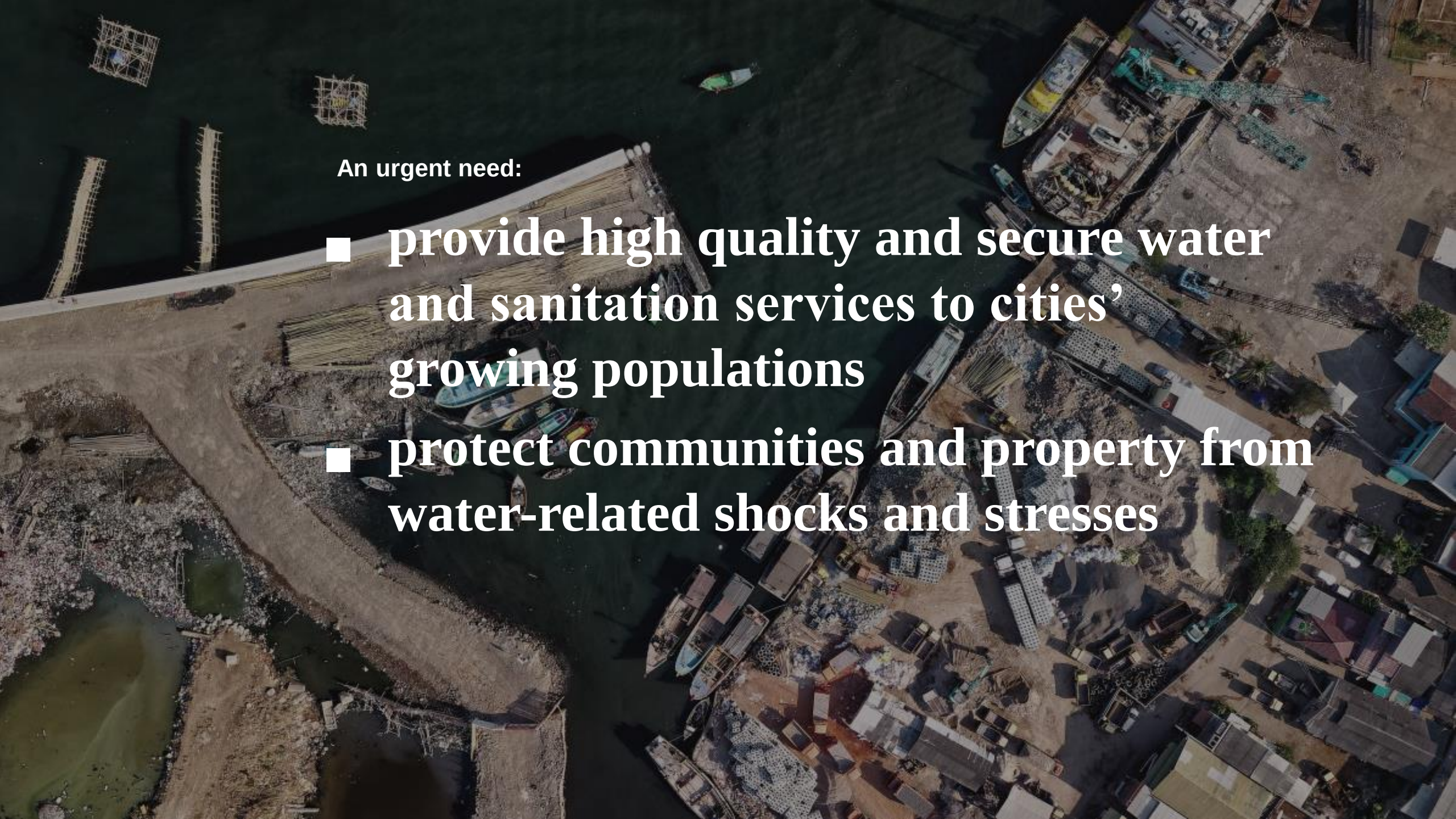
Connecting residents through water-based mobility and activity.

Protecting people and their possessions from water-related hazards, including flooding and drought.

Protecting the natural environment from pollution and degradation.

2

The Importance of Water Resilience



An urgent need:

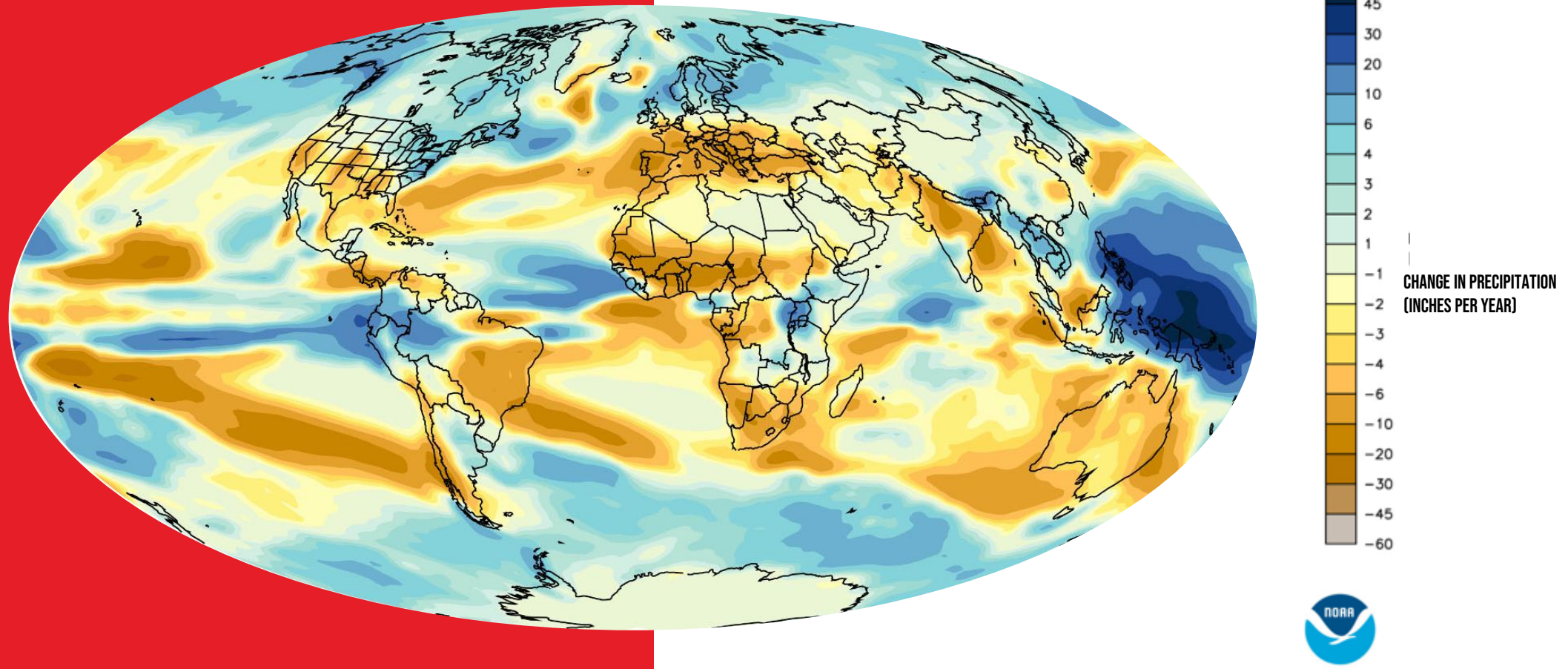
- provide high quality and secure water and sanitation services to cities' growing populations
- protect communities and property from water-related shocks and stresses

Urbanisation

Shanghai – 1990 to 2010

(Image: The Urbanist)

Climate Change



Change in precipitation by the end of 21st Century

3

Shocks & Stresses

Shocks

Short duration – high impact

Climate

Flood
Storms
Drought
Heat Wave

Security Related Incidents

Fire (Third Party)
Terrorism / Hoax
Cyber Attack / Data Fraud
Vandalism
False Positive Alarm
Poisoning (Third Party)
Water Contamination

Economic Change

Brexit
Recession
Fraud

Asset Related Incidents

Infrastructure Failure
Fire / Explosion
Operational Deaths / Drownings
Poisoning
Pollution
Infectious Diseases
Natural Disasters
Nuclear Incident

Supply Chain

Third Party Service Failure
Civil Unrest
Supply Chain Failure
Staff Strikes
Industrial Disputes
Power Outage
Severe Energy Price Change
Comms Outage

Stresses

Longer duration – incremental impact

Climate

Changing Rainfall Patterns
Regional Water Stress
Sea Level Rise / Coastal Erosion
Resource Scarcity

Legislative Change

Water Act
Water Quality Regulations
Abstraction Licenses Change
Change in Land Use
Sentencing Council Guidelines

Economic Change

Unmanageable Inflation
Increased Cost of Borrowing
Macro Industry Change

Customers

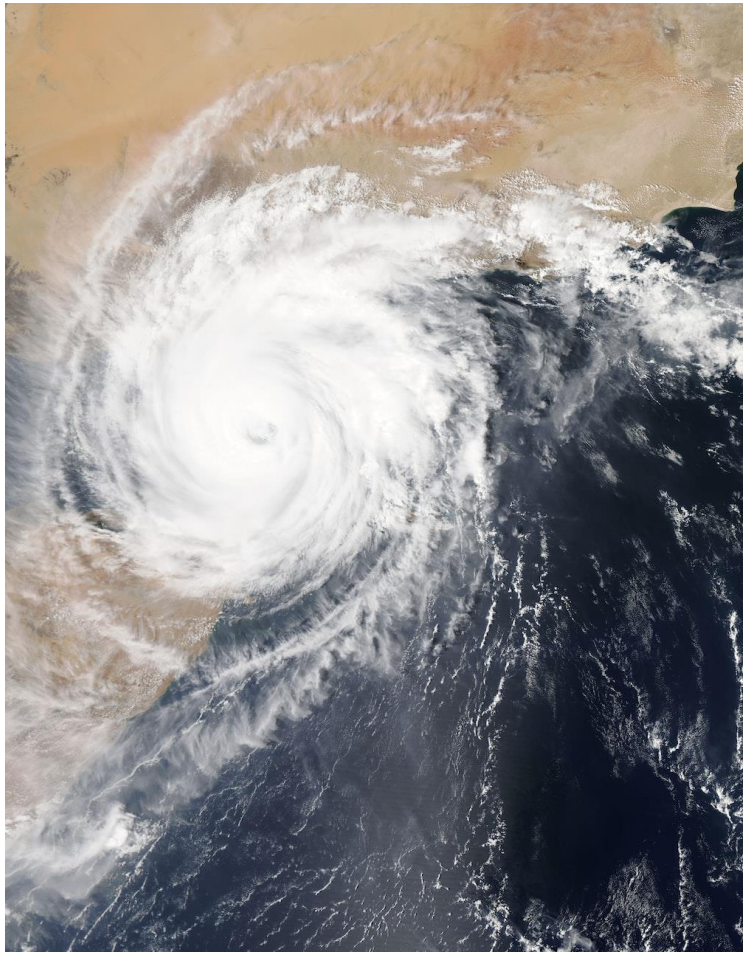
Demographic Change / Economic Development
Trend of Urbanism / Urban Creep
Population Change
Migration
Increased Water Demand Per Capita
Willingness to pay

Supply Chain

Skills Shortages
Employment Costs
Energy Costs
Comms Costs

Black Swans

A ‘black swan’ is a high impact, but extremely low probability event



Natural Disaster

Storm surge
Hurricane
Tropical Cyclone
Tsunami
Landslides

Critical Asset Failures

Gas explosions
Dam failures
Electricity outages

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WATER RESILIENCE

CAPITALISING ON THE COMMERCIAL OPPORTUNTIES FOR UK PLC

A Capability Capture and Call to Action
by the UK Water Partnership

FEBRUARY 2022

City Water Resilience Approach

Organisation(s)
Arup & Stockholm International Water Institute (SIWI)

Client(s)
Government Departments, City Councils, Utility Companies

Location

Major Cities, Global

Focus Area

- Digital Water
- Water Resilience
- Net Zero

Service Offering

- Research
- Advisory
- Design
- Build
- Operate

UK Capability

- Now (existing capability)
- New (emerging capability)
- Next (future capability)

Overview

A changing climate coupled with rapid urbanisation has resulted in unpredictable rainfall, flooding, droughts and other water-related shocks and stresses on cities. With over 2 billion new urban citizens anticipated by 2050, cities increasingly recognise the need for better understanding of the water-related risks, and for tools that help prioritise action and investments to become more resilient. Across the world, decision makers are focusing on the central role water plays in the life of cities. Arup and the Stockholm International Water Institute (SIWI) developed the City Water Resilience Approach (CWRA) to help cities understand the risks they face, and improve the way they plan, manage and maintain their water system.

Using the approach

Funded by The Resilience Shift and the Rockefeller Foundation, the CWRA builds on the City Resilience Index, bringing the same forensic research methodology to the issue of water for the first time. It's a five-step approach, which starts by engaging stakeholders and understanding how the underlying water basin is comprised. We then assess current resilience: could the city withstand enduring drought, sudden flooding, further urban development or other local risks? Steps three, four and five plan the actions that will improve water resilience, develop relevant local adaptations and put monitoring in place. Cities as diverse as Cape Town, Mexico City, Miami, Amman, Thessaloniki, Manchester, Rotterdam and Hull have helped us to develop this approach to improve their own understanding and management of water. Seven of the eight cities are part of 100 Resilient Cities – Pioneered by The Rockefeller Foundation (100RC), which helps cities around the world become more resilient in the face of physical, social and economic challenges.

Key Words

water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
buildings and public realm	rivers and waterways	
asset management	small infrastructure	coasts

For more information

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Phone	+44 20 7755 3598
Website	www.arup.com/perspectives/how-can-we-build-more-water-resilient-cities

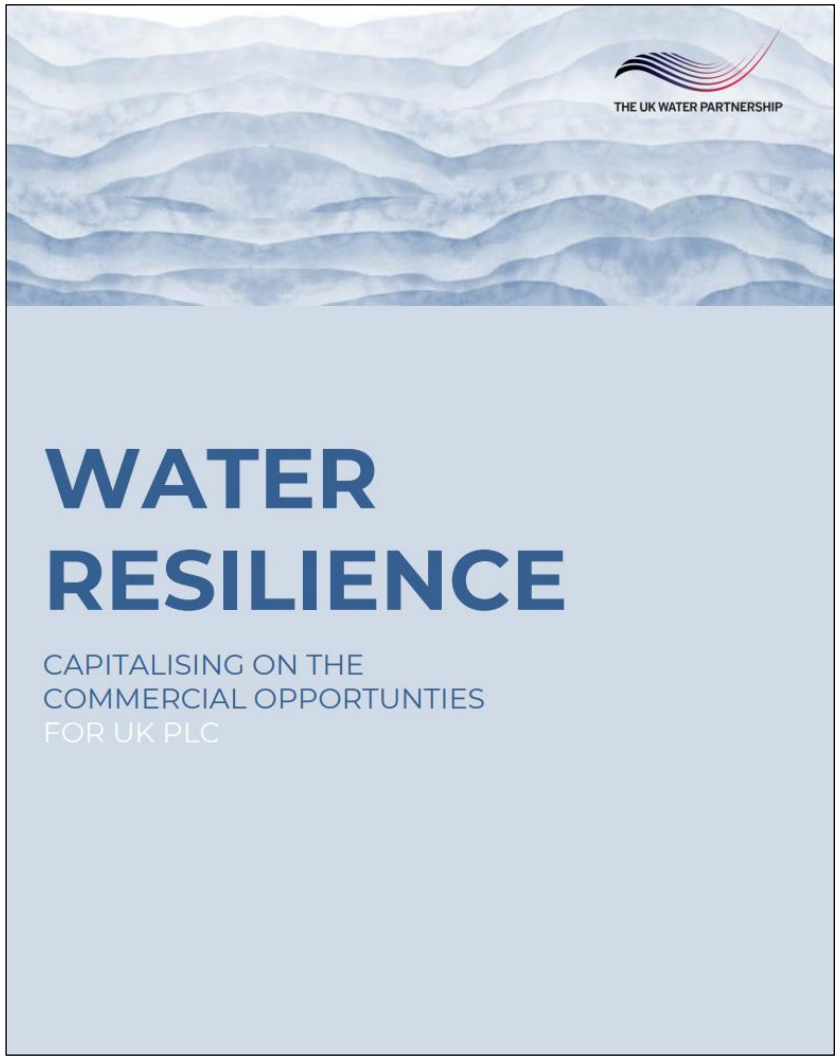
Company profiles

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. From 90 offices in 35 countries, their 10,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion. The successful design, development and maintenance of our water infrastructure requires the integration of many disciplines.

Arup's water team has wide-ranging skills spanning advisory and specialist technical services. We apply them on every kind of project, from flood risk management and water resource planning, to dam engineering, treatment works design and river engineering.

Stockholm International Water Institute (SIWI) is a Stockholm-based policy institute that generates knowledge and guides decision-making towards water wise decisions.

Founded in 1991, SIWI performs research, builds institutional capacity and provides advisory services in five thematic areas: water governance, transboundary water management, water and climate change, the water-energy-food nexus, and water economics.



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www.theukwaterpartnership.org

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1

Planning for Resilience

A Resilient Water Future

The City Water Resilience Approach
Cape Town – Day Zero
Arup

Martin Shouler
Water team Leader

Martin.shouler@arup.com

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Water Resilience and the City Water Resilience Approach (CWRA)

About Arup
City Water Resilience Approach (CWRA)
Case of Cape Town
Further information

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Worldwide offices

ARUP

From 90 offices, some 19,000 planners, designers, engineers and consultants deliver more than 18,000 innovative projects yearly across the world

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City Water Resilience Approach

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A collaborative approach

Partnerships for water resilience

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City Water Resilience Approach

Track record

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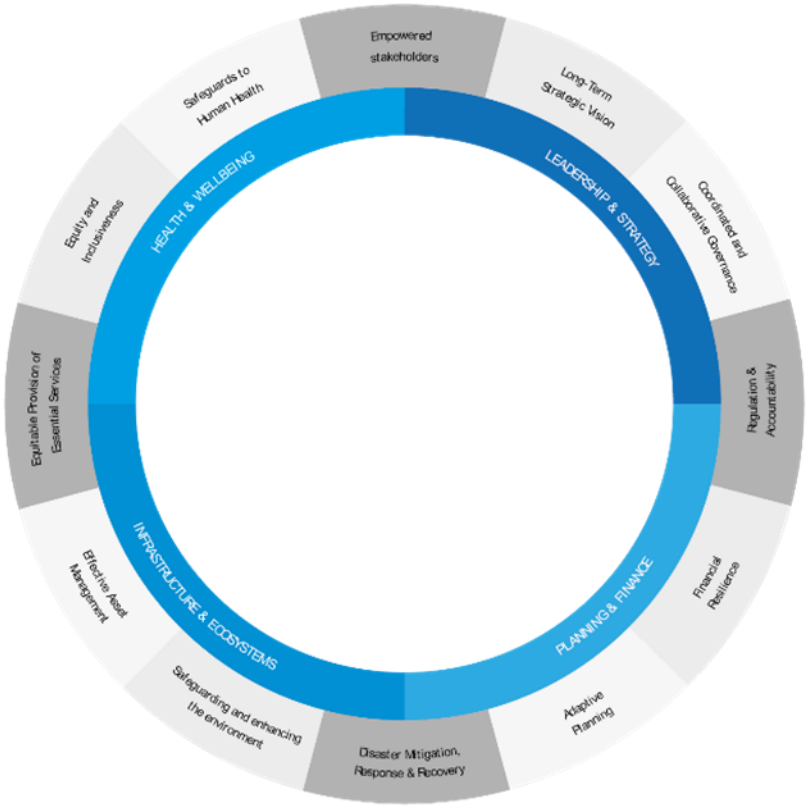
City Water Resilience Approach

Key features

Inclusive and transparent	Brings together different perspectives from water and city stakeholders and encourages collective action
Systems-based	Takes account of inter-dependencies with other systems
Holistic	Includes leadership and strategy, planning and finance, infrastructure and ecosystems and personal, household and community resilience
Action-oriented	Encourages the ownership, development and progression of actions to improve water resilience



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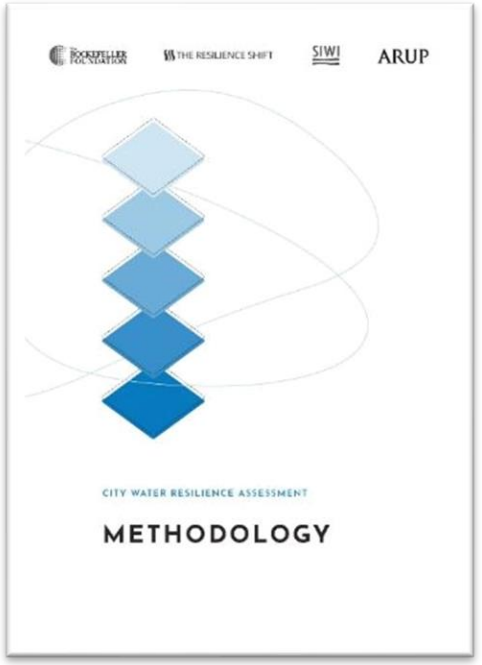
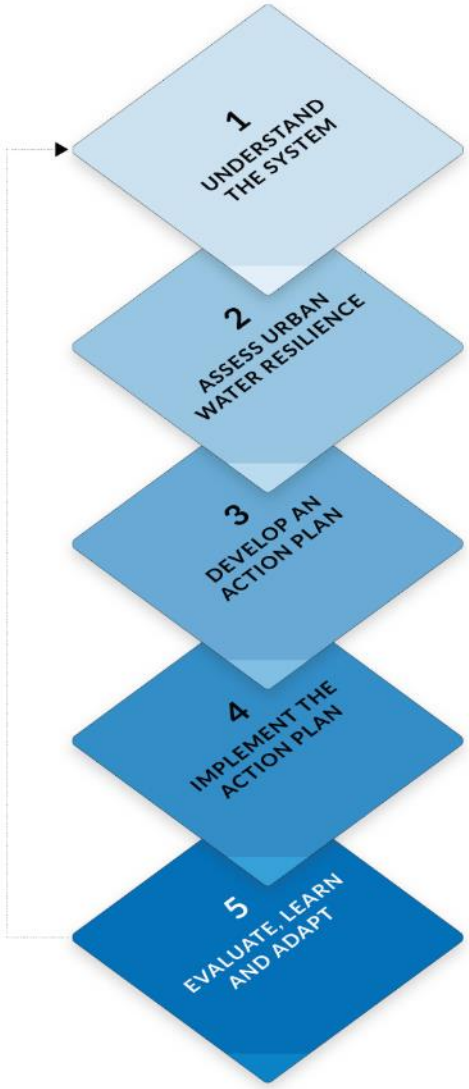
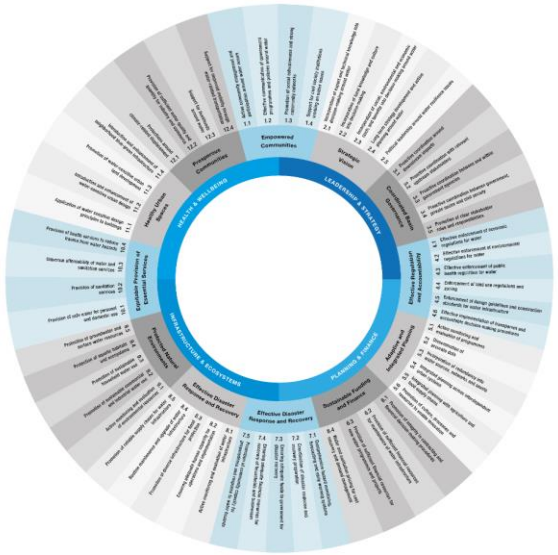
City Water Resilience Approach

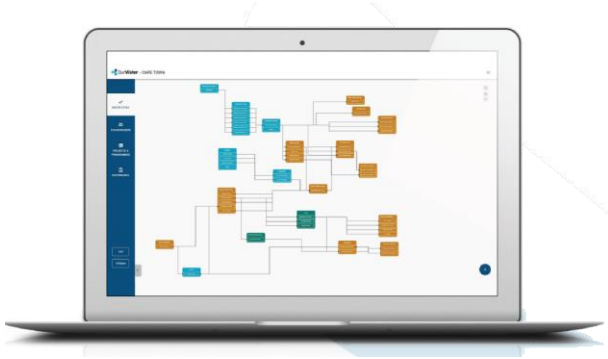




City Water Resilience Approach



City Water Resilience Framework



OurWater Governance Tool

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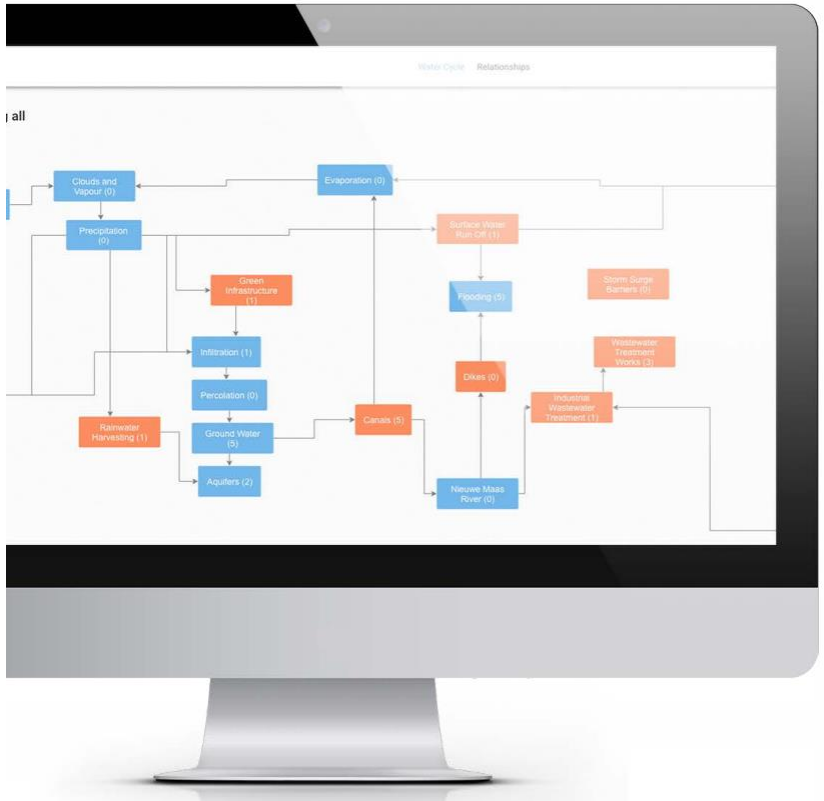
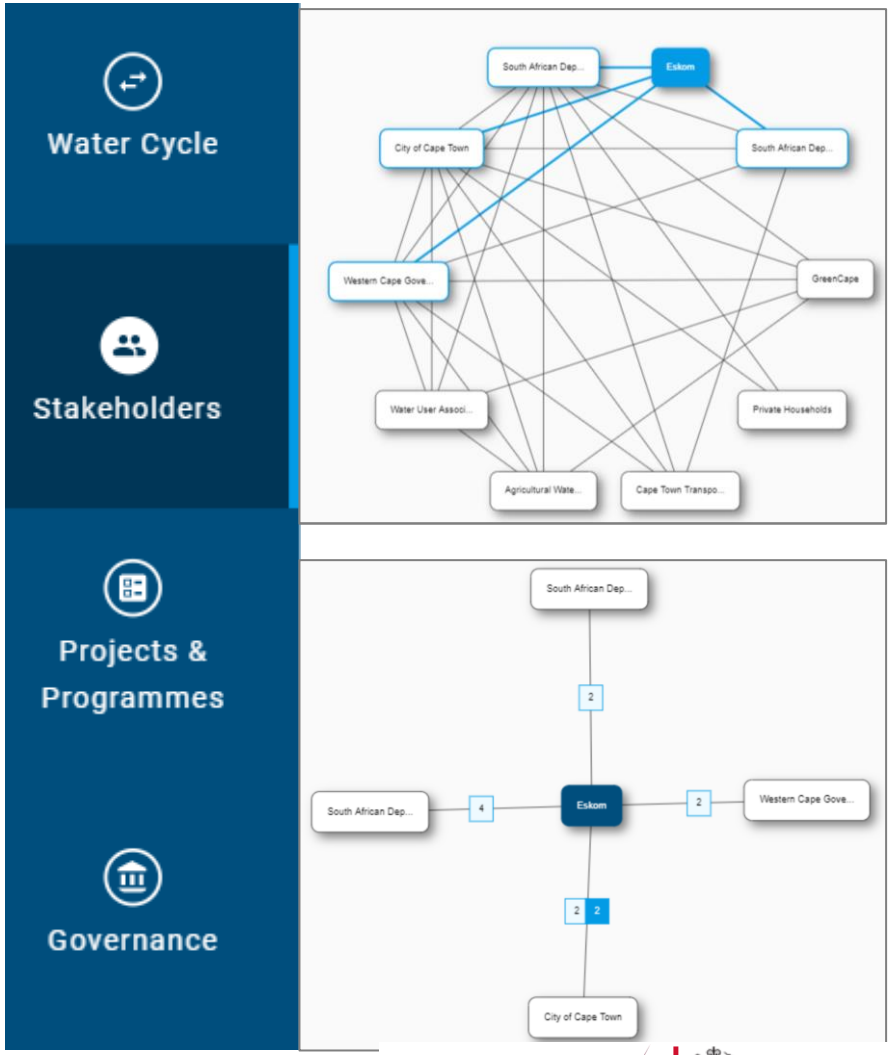
Step 1: Understand the system

OurWater





https://app.ourwater.city/

Red Room

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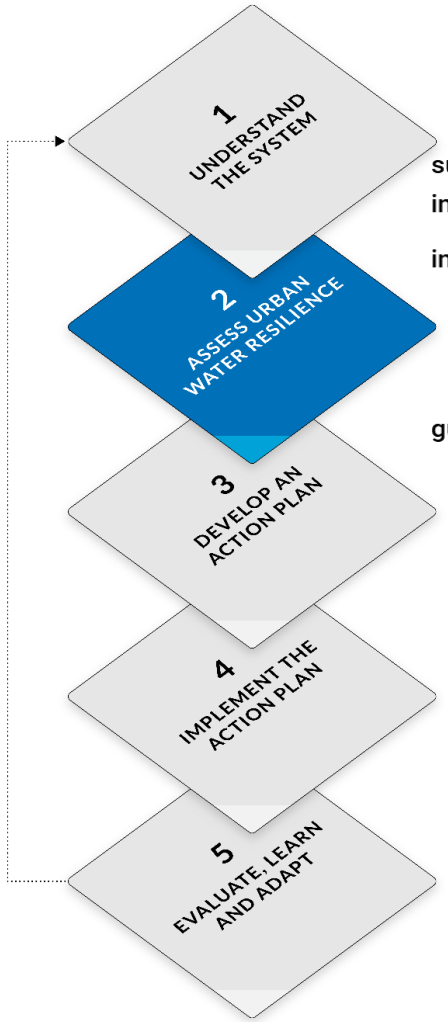
Step 2: Assess urban water resilience – Shocks and Stresses

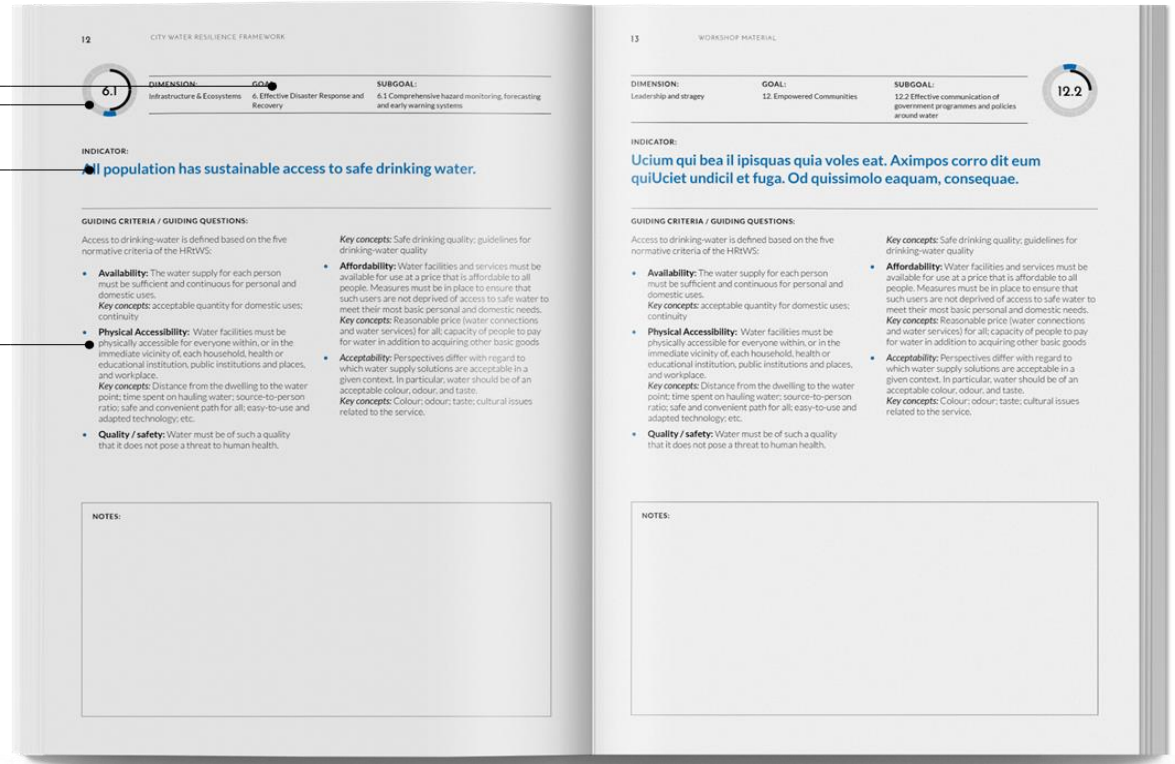


sub-goal

indicator #

indicator name

guiding criteria



12 CITY WATER RESILIENCE FRAMEWORK

DIMENSION: Infrastructure & Ecosystems | GOAL: 6. Effective Disaster Response and Recovery | SUBGOAL: 6.1 Comprehensive hazard monitoring, forecasting and early warning systems

6.1

INDICATOR:

ll population has sustainable access to safe drinking water.

GUIDING CRITERIA / GUIDING QUESTIONS:

Access to drinking-water is defined based on the five normative criteria of the HRtWS:

- **Availability:** The water supply for each person must be sufficient and continuous for personal and domestic uses.
  Key concepts: acceptable quantity for domestic uses; continuity
- **Physical Accessibility:** Water facilities must be physically accessible for everyone within, or in the immediate vicinity of, each household, health or educational institution, public institutions and places, and workplace.
  Key concepts: Distance from the dwelling to the water point; time spent on hauling water; source-to-person ratio; safe and convenient path for all; easy-to-use and adapted technology; etc.
- **Quality / safety:** Water must be of such a quality that it does not pose a threat to human health.
  Key concepts: Safe drinking quality; guidelines for drinking-water quality
- **Affordability:** Water facilities and services must be available for use at a price that is affordable to all people. Measures must be in place to ensure that such users are not deprived of access to safe water to meet their most basic personal and domestic needs.
  Key concepts: Reasonable price (water connections and water services) for all; capacity of people to pay for water in addition to acquiring other basic goods
- **Acceptability:** Perspectives differ with regard to which water supply solutions are acceptable in a given context. In particular, water should be of an acceptable colour, odour, and taste.
  Key concepts: Colour; odour; taste; cultural issues related to the service.

NOTES:

13 WORKSHOP MATERIAL

DIMENSION: Leadership and strategy | GOAL: 12. Empowered Communities | SUBGOAL: 12.2 Effective communication of government programmes and policies around water

12.2

INDICATOR:

Ucium qui bea il ipisquas quia voles eat. Aximpos corro dit eum quiUciet undicil et fuga. Od quissimolo eaquam, consequae.

GUIDING CRITERIA / GUIDING QUESTIONS:

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NOTES:

5 OPTIMAL	4 GOOD	3 FAIR	2 LOW	1 POOR	N/A
The indicator fully reflects current conditions in the city. No improvement is required.	The indicator mostly reflects conditions in the city. Minimal improvement is required.	The indicator somewhat reflects conditions in the city. Some improvement is required.	The indicator mostly does not reflect conditions in the city. Significant improvement is required.	The indicator does not at all reflect current conditions in the city.	The indicator is not relevant to the city.

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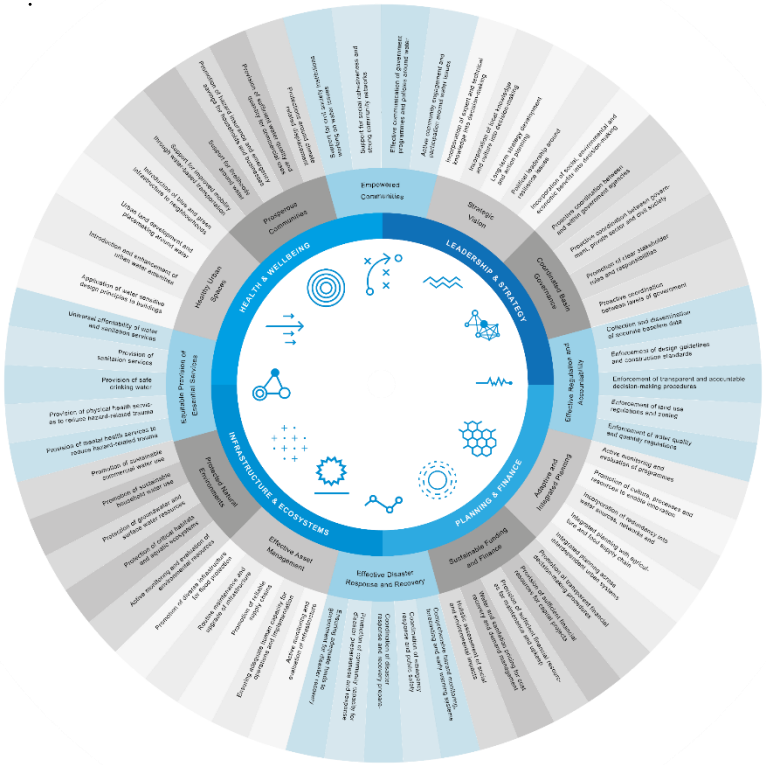
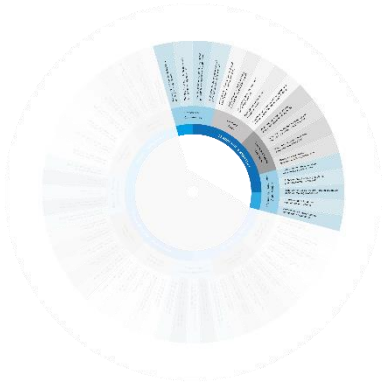
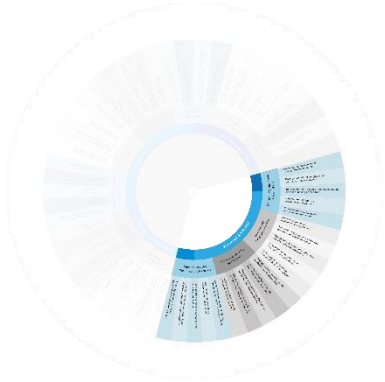
City Water Resilience Framework



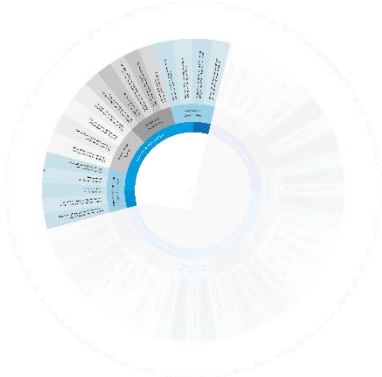
Leadership & Strategy



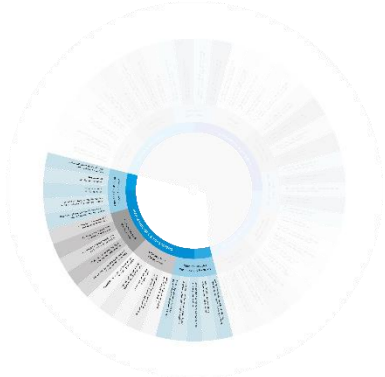
Planning & Finance



Infrastructure & Ecosystems



Health & Wellbeing



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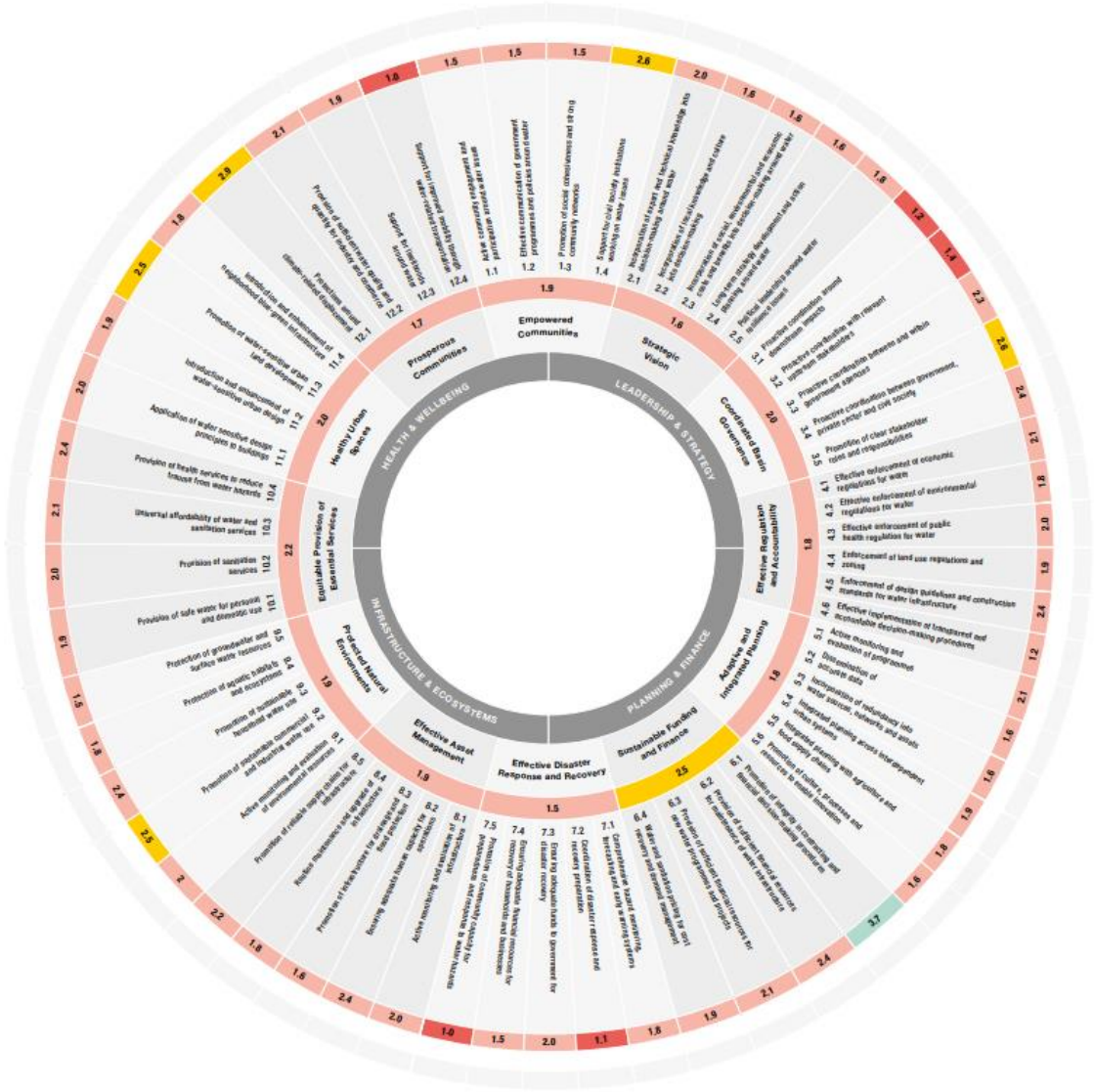
A common understanding of Water Resilience



Addis Ababa
Water Resilience Profile

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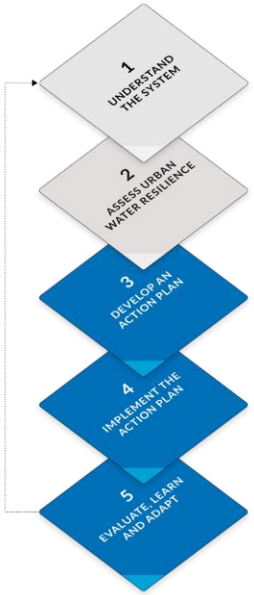
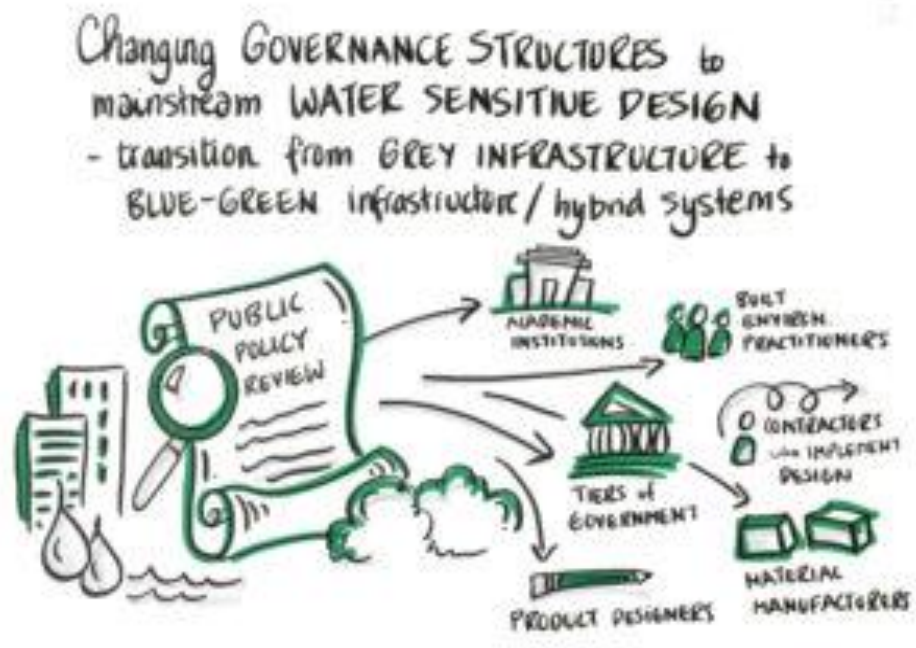
Step 3: Develop a targeted action plan



- Problem statement selection
- Root cause analysis
- Visioning
- Opportunity development
- Critical friend review
- Intervention development
- Marketplace prioritisation
- City Water Resilience Profile and Action Plan



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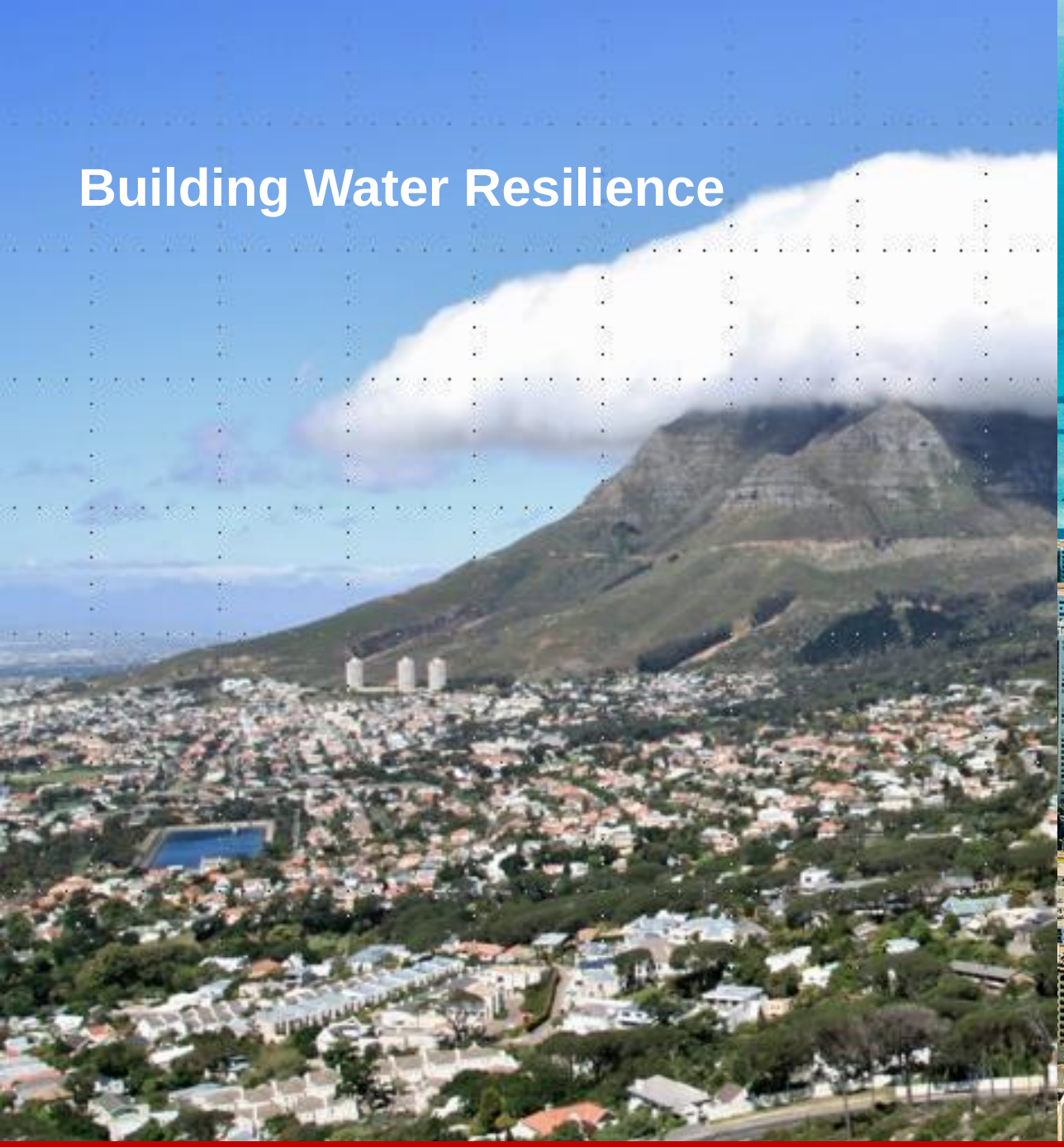
Building Water Resilience



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Red Room

ARUP

2

Case Study: Cape Town

Red Room

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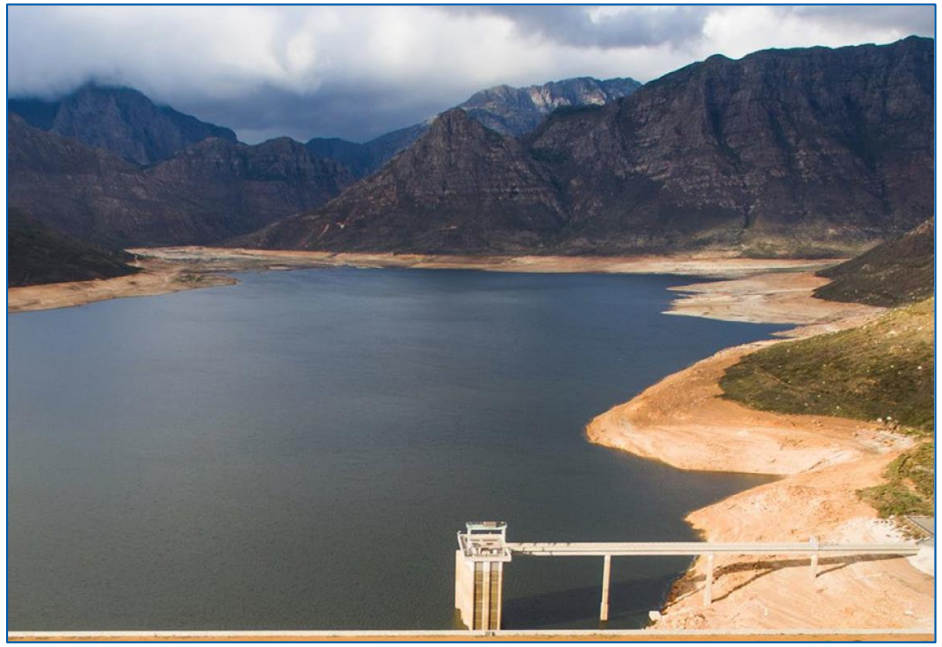
Cape Town

Cape Town



Cape Town

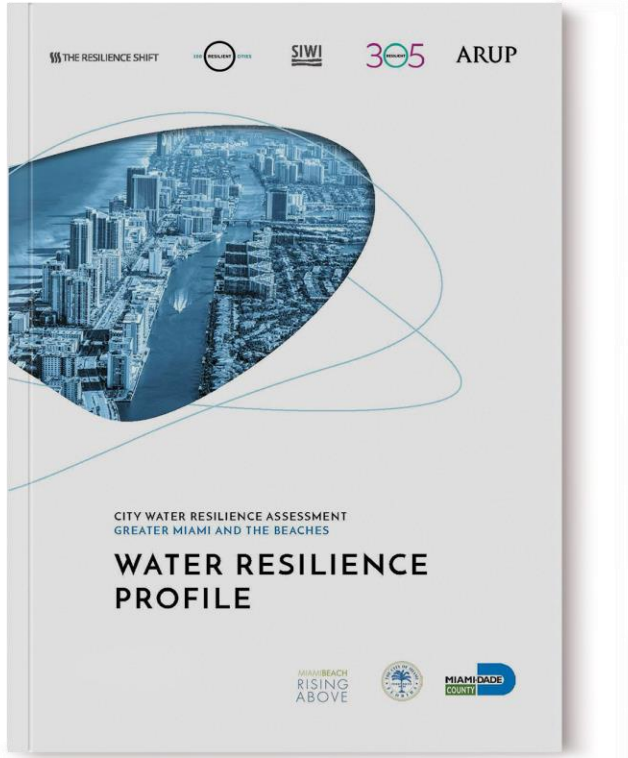
"Using a resilience lens to analyse our water system and build programmatic responses is a useful way to deal with uncertainty. Climate change, rapid urbanisation and technological change all pose challenges to our water future. We are therefore privileged that Cape Town was the first city in the world to have been selected to deploy the City Water Resilience Framework (CWRF)."

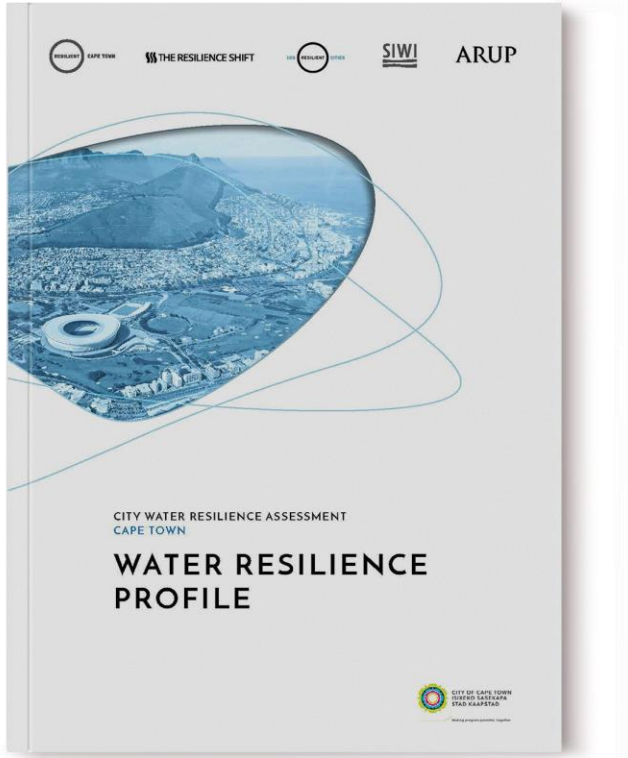
Mike Webster, Director of Water and Sanitation, City of Cape Town

Gareth Morgan, Director of Resilience, City of Cape Town

Councillor Xanthea Limberg, Mayoral Committee Member for Water and Waste, City of Cape Town

City Water Resilience Profile & Action Plan





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Cape Town

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Making progress possible. Together.

1

SAFE ACCESS TO WATER AND SANITATION

The City of Cape Town metropolitan municipality[2] will work hard to provide and facilitate safe access to water and sanitation for all of its residents in terms of well-defined minimum standards. In particular, the City will work with communities in informal settlements and with other stakeholders to improve the daily experience of access to water and sanitation, with an emphasis on building trust and increasing safety within these communities through this process.

2

WISE USE

The City will promote the wise use of water by all water users. This will include promoting water conservation behaviour through (a) pricing water with reference to the cost of providing additional supply, while retaining the commitment to provide a basic amount of water for free for those not able to afford this; (b) revising by-laws and planning requirements, and using other incentives to support water efficiency and the treatment and reuse of water; (c) supporting active citizenship by substantially improving customer management and engagement; and (d) managing the water network effectively to reduce losses and non-revenue water.

3

SUFFICIENT, RELIABLE WATER FROM DIVERSE SOURCES

The City will develop new, diverse supplies of water including groundwater, water reuse and desalinated water, cost effectively and timeously to increase resilience[3] and substantially reduce the likelihood of severe water restrictions in future. The City is committed to increasing supply by building affordable new capacity of approximately 300 million litres per day over the next ten years, and in suitable increments thereafter, in a way that is adaptable and robust to changes in circumstances.

4

SHARED BENEFITS FROM REGIONAL WATER RESOURCES

The City will work with key stakeholders and partners, including other urban and agriculture water users and other spheres of government, to make the most of the opportunities to optimise the economic, social and ecological benefits of regional[4] water resources, and to reduce the risks. The City will do this through collaborative processes.

5

A WATER-SENSITIVE CITY[5]

The City will actively facilitate the transition of Cape Town over time into a water-sensitive city with diverse water resources, diversified infrastructure and one that makes optimal use of stormwater and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and is based on sound ecological principles. This will be done through new incentives and regulatory mechanisms as well as through the way the City invests in new infrastructure.

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CWRA: City to City Learning

Common challenges facing cities:

- Need for coordination between upstream water stakeholders and city systems providers
- Data-driven decisions in times of disaster and for long-term planning
- Community engagement including vulnerable communities
- Making the case for resilience investments
- Protection of surface water and ground water including data, regulation and enforcement

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The City Water Resilience Approach

A resilient water future

Red Room

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Programme – 30/06/23

Red Room

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Blue Room

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2

Planning for Resilience

Planning under Uncertainty

DMDU: Decision making under deep Uncertainty for resilience

Nexsys Analytics / Arup

Julien Harou
Prof, Chair in Water Engineering
The University of Manchester

www.linkedin.com/company/nexsys-analytics

Nexsys analytics

Resilient Infrastructure Investments for Resource Security

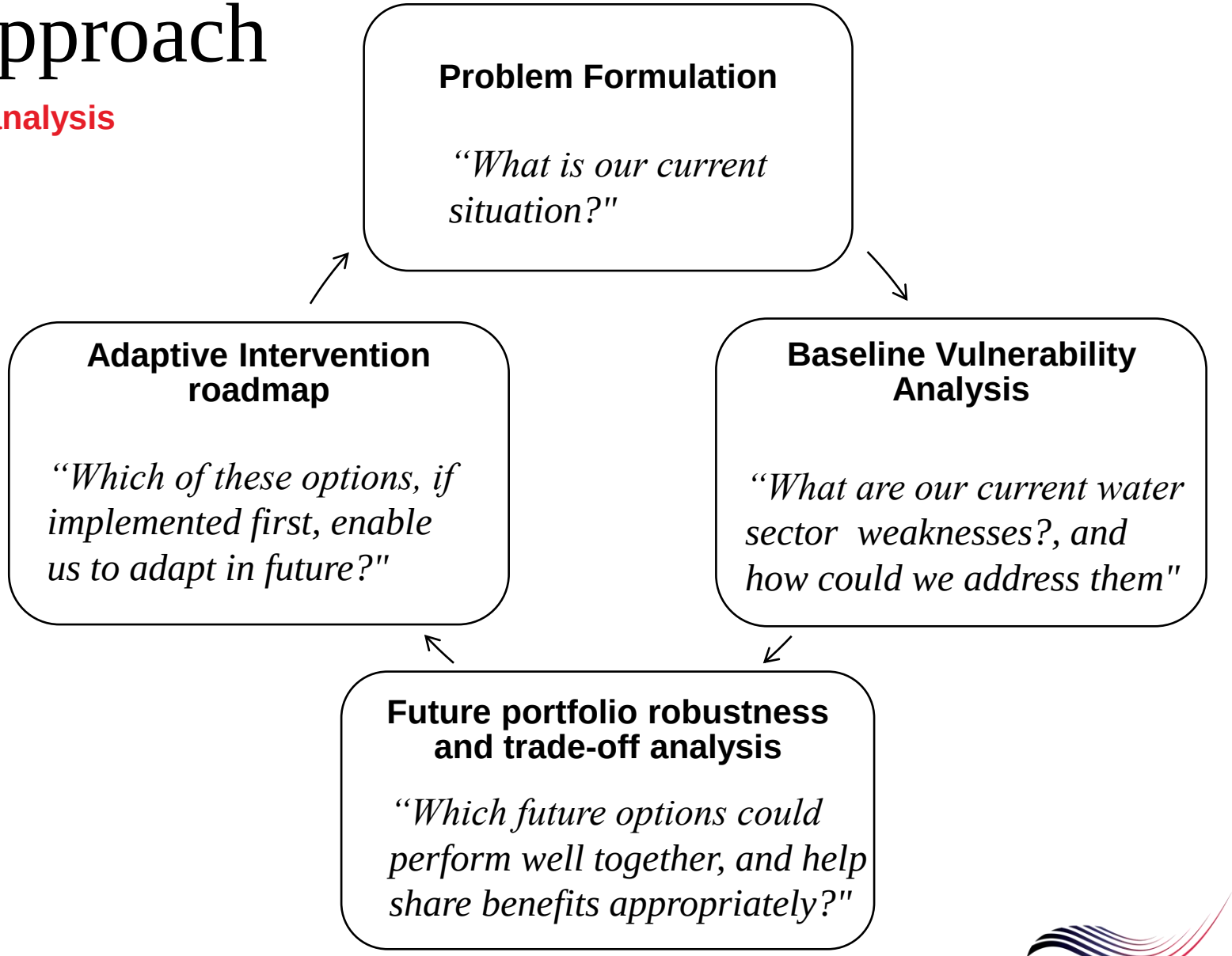
Strategic national scale design under uncertainty

Julien Harou, Nexsys Analytics

ARUP Nexsys analytics THE WORLD BANK THE UK WATER PARTNERSHIP Department for Business & Trade

Resilience Approach

Good questions drive the analysis



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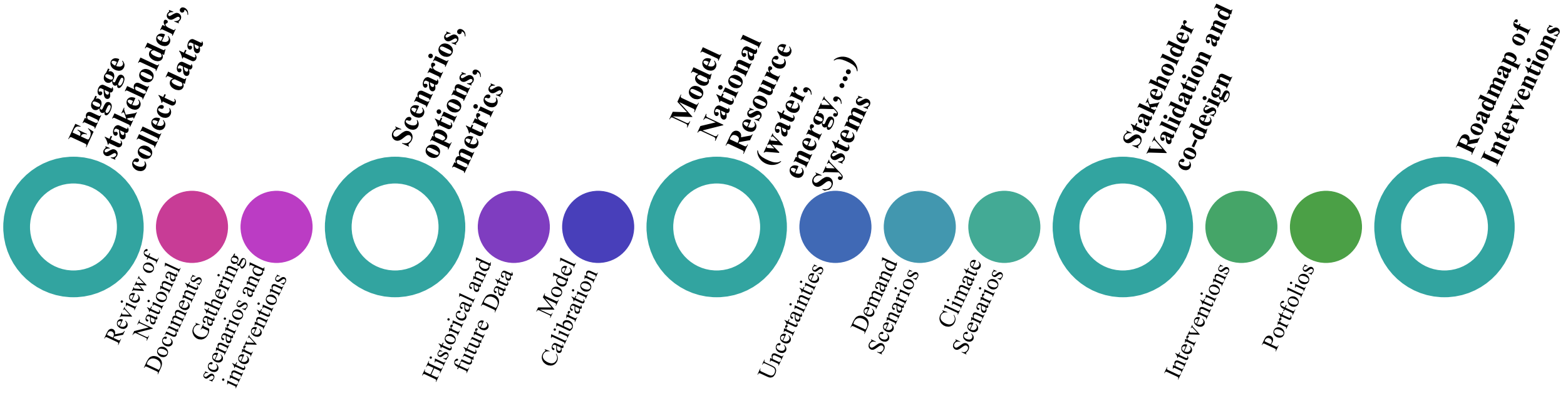
Stakeholder interaction



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Identifying scenarios, intervention options (Botswana case-study)

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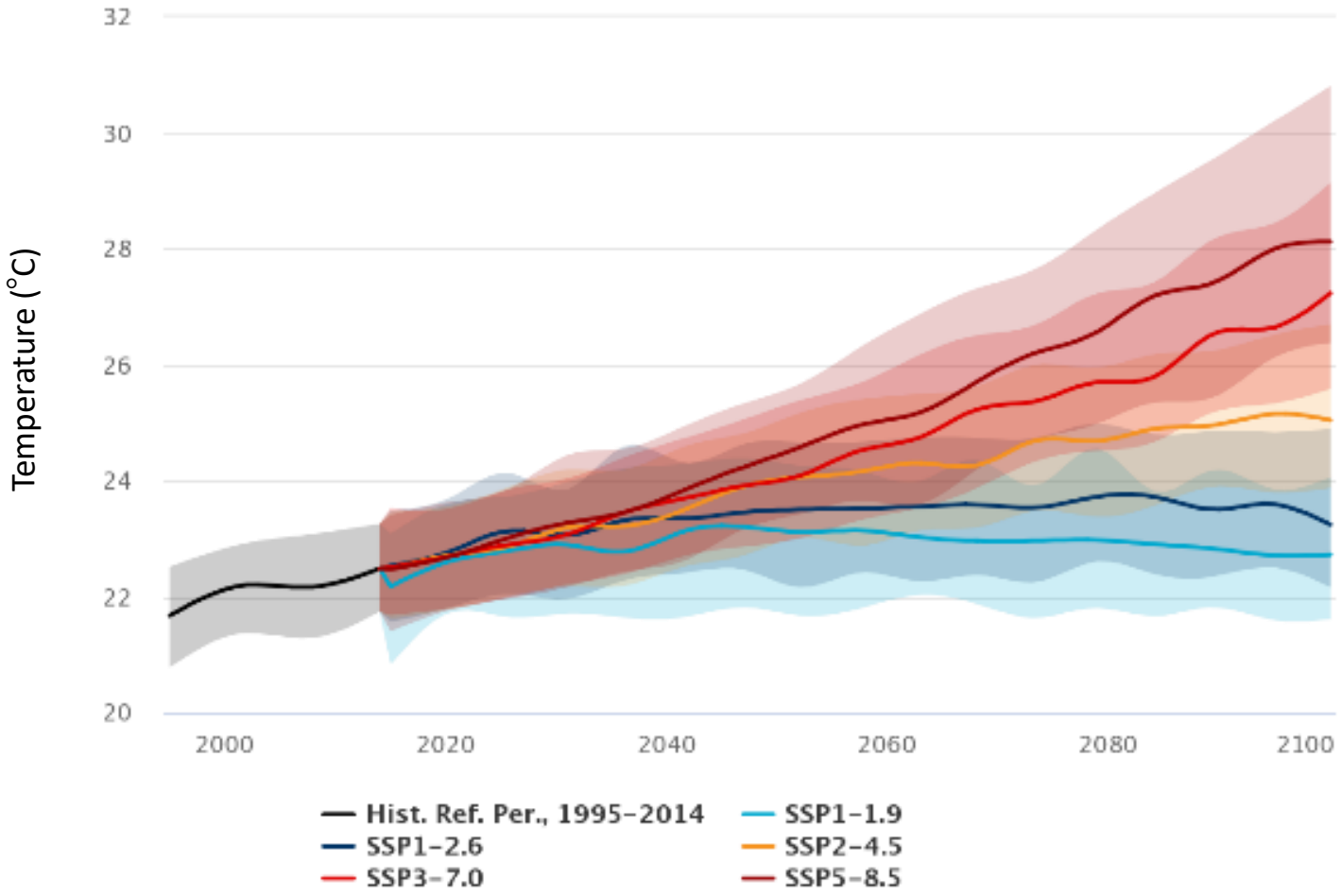
Climate Scenarios



CMIP6 - Projected annual mean temperature, Botswana

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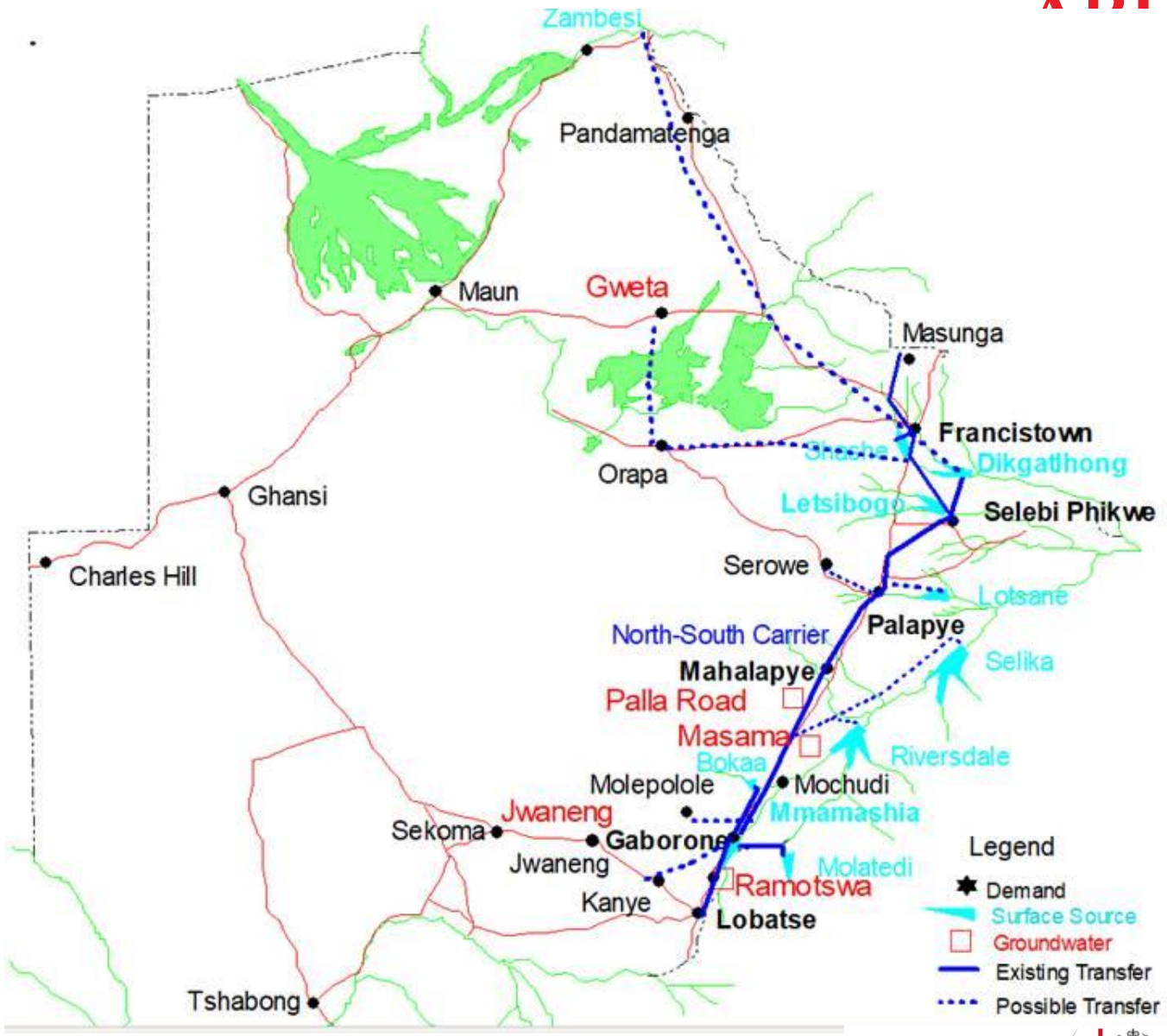
Interventions

Chobe-Zambezi Water Transfer Scheme Phase 1 and 2
Lesotho Highland Water Transfer Scheme
Walvis Bay seawater desalination plant project
Wastewater reclamation for domestic purposes
National-scale Rainwater harvesting
Feasibility study on floating solar system in Bokaa dam
Development of Mosetse Dam
Stormwater Harvesting System



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Model-assisted national resource system design given deep uncertainty (Botswana case-study)

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Botswana application

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Scenarios

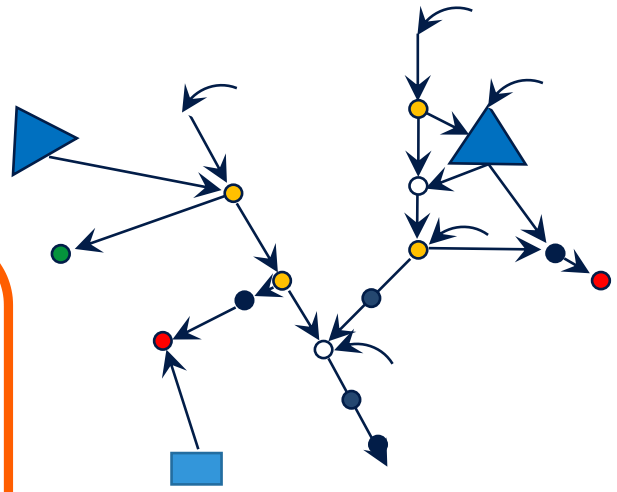
- Hydrology
- Climate Change
- Demand

Possible options

- Chobe-Zamezi
- Stormwater
- Rainwater harvestng
- Reuse
- Lesotho Transfer
- Mosetse reservoir
- Floating solar
- Walvis bay desal

National simulation model

representing baseline system or
Baseline system + portfolio of options



Output

Metrics representing performance over different scenarios

- Reservoir reliability and resilience
- Supply reliability and resilience
- Annual deficit
- Capex and opex costs
- Robustness
- Maintenance of natural capital
- Portfolio feasibility

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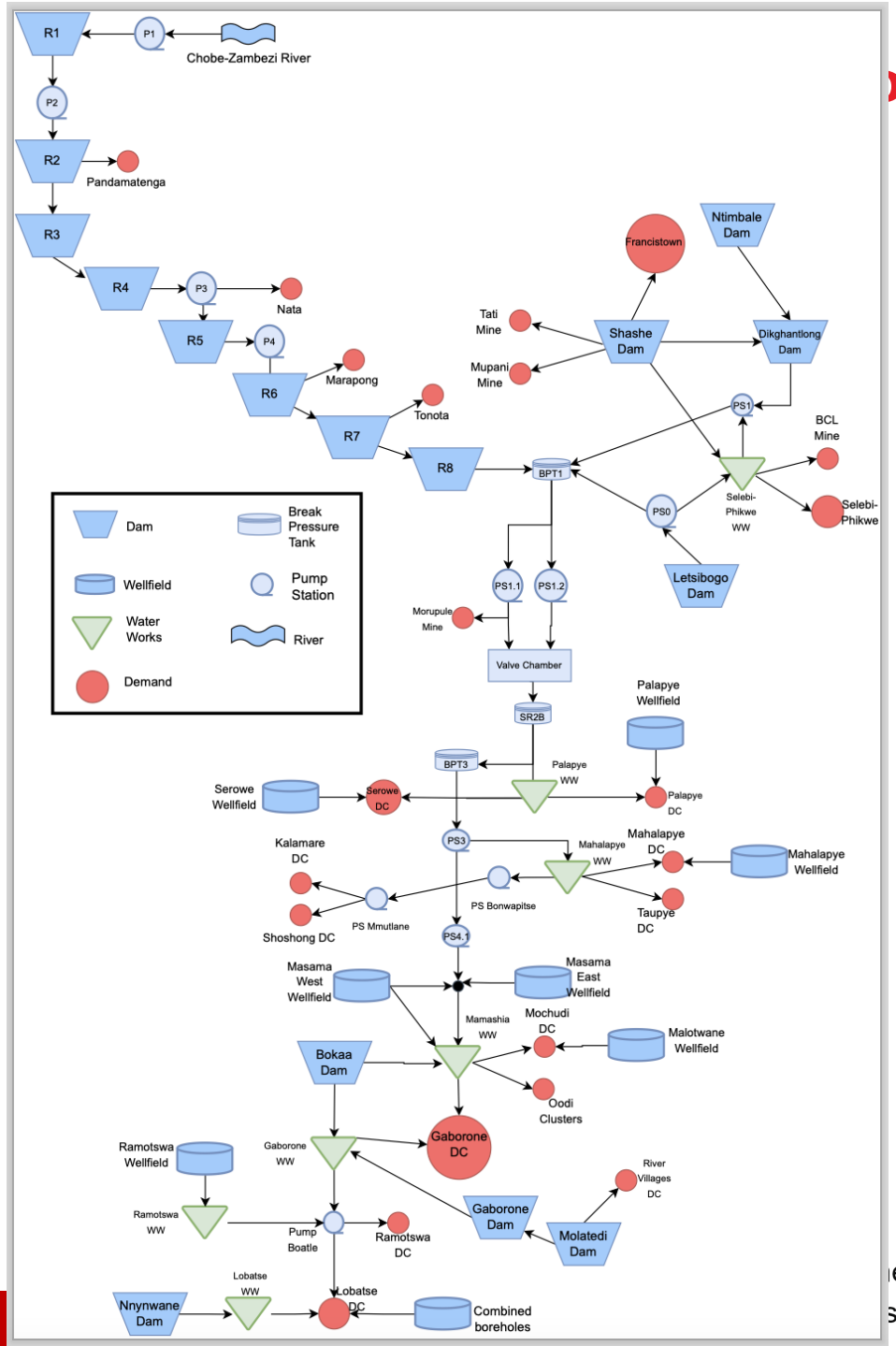
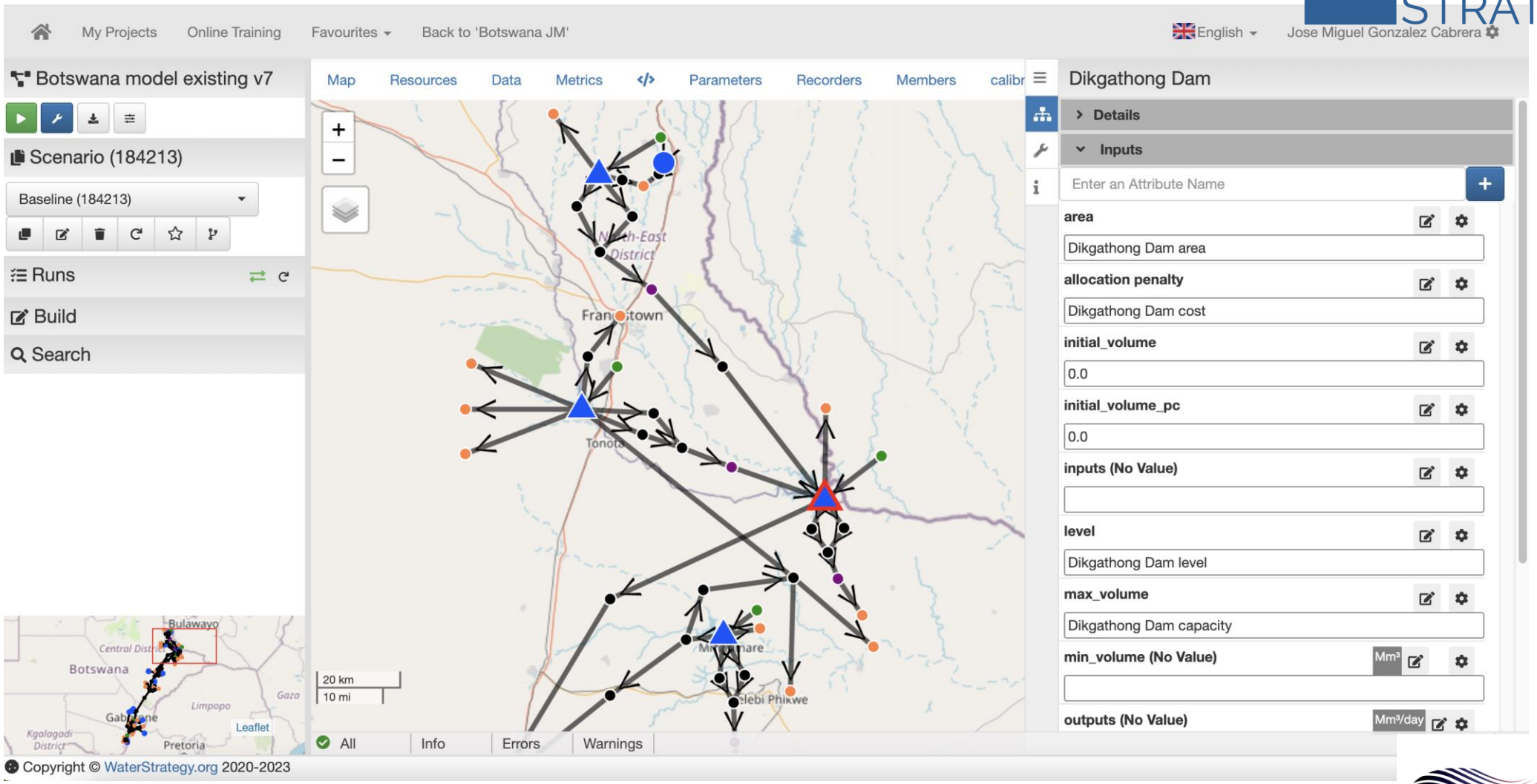
Botswana national case-study

- Open-source Python water resources (Pywr)
- Online WaterStrategy.org model

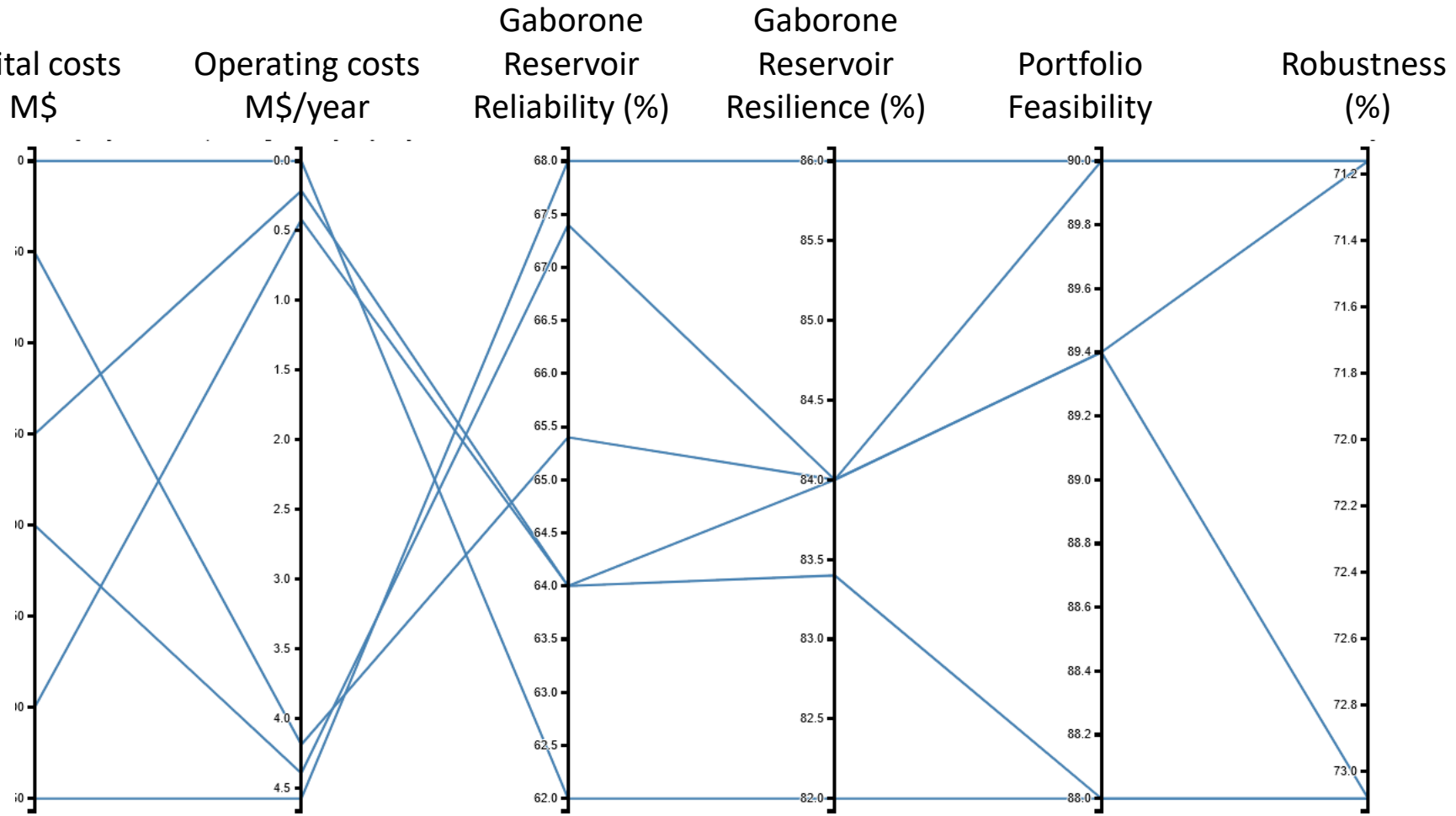


Model online at WaterStrategy.org



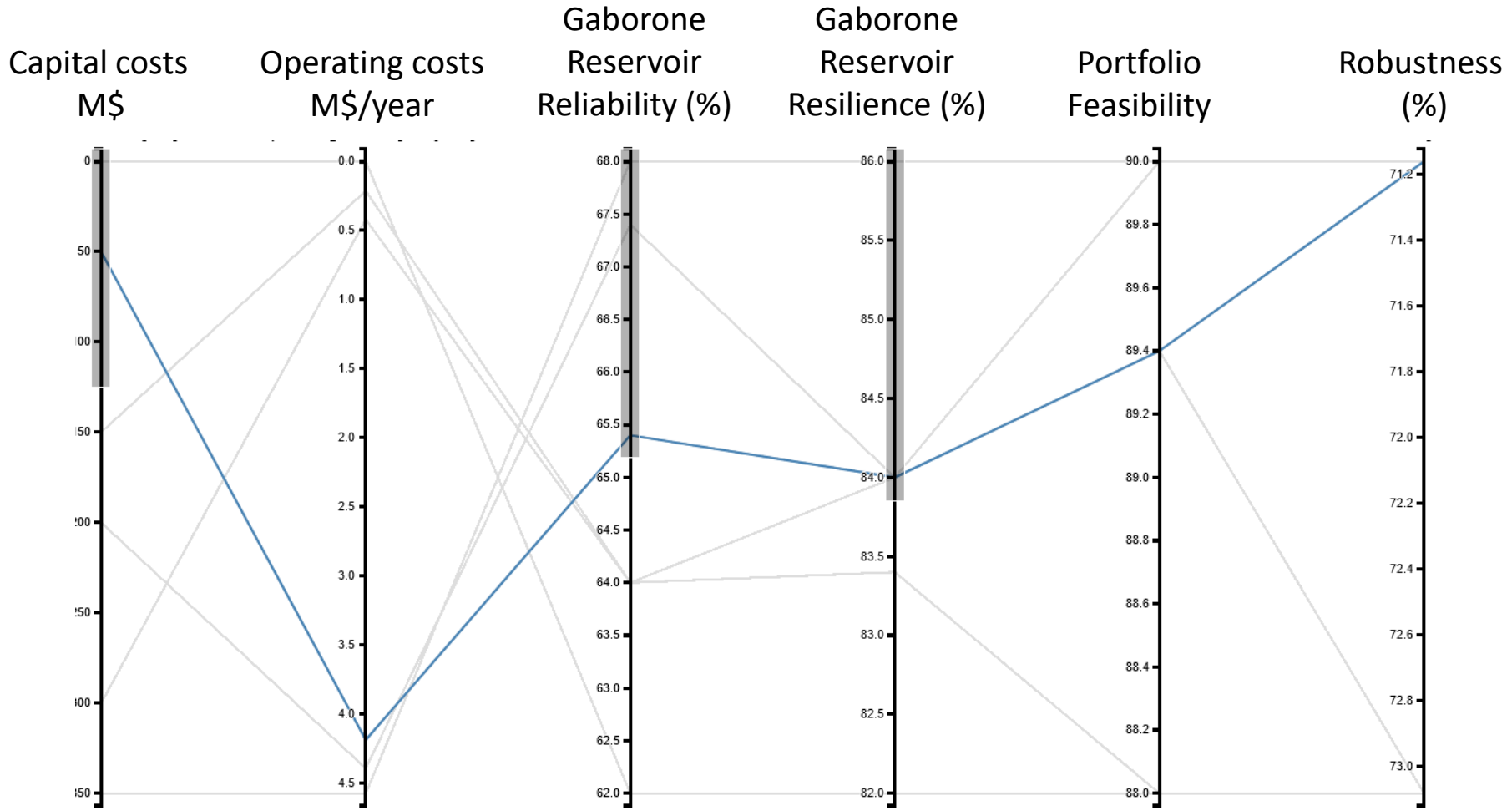
Multi-criteria assessment of portfolios

We use multi-criteria plots to visualize portfolio performance

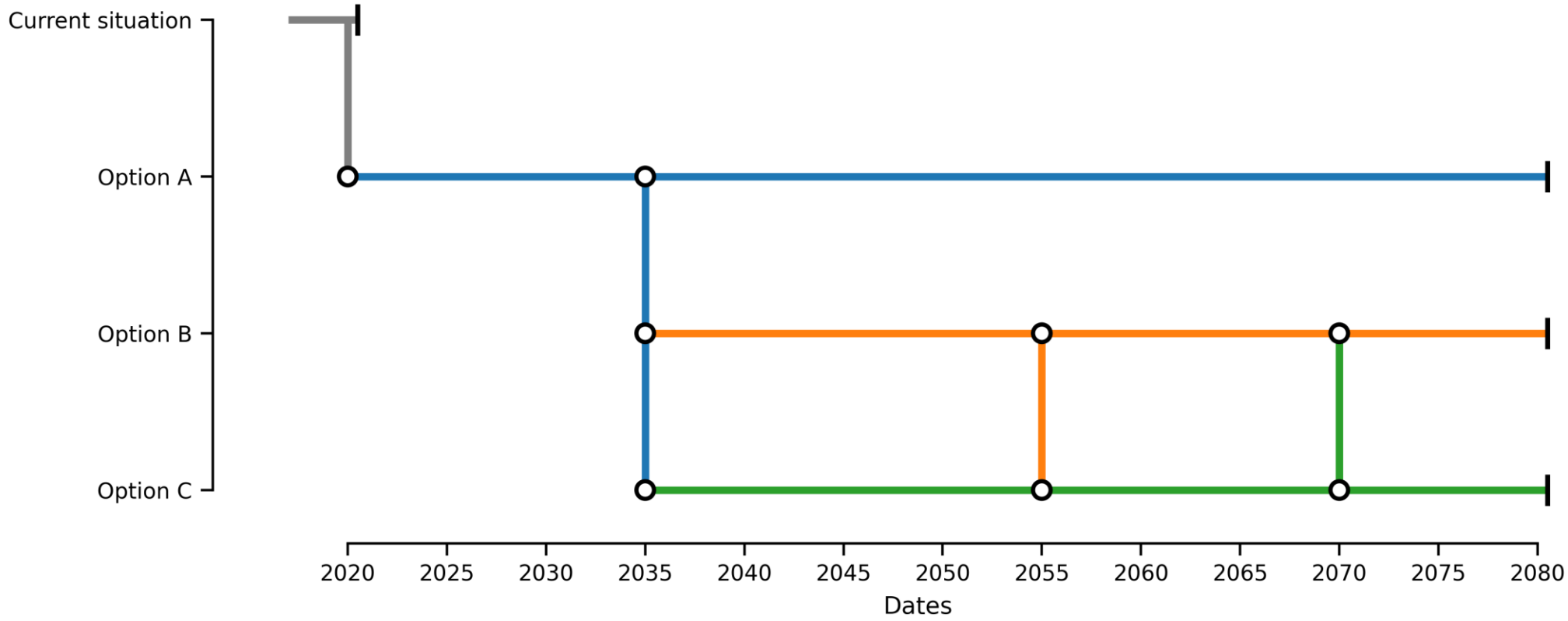


Selecting portfolios

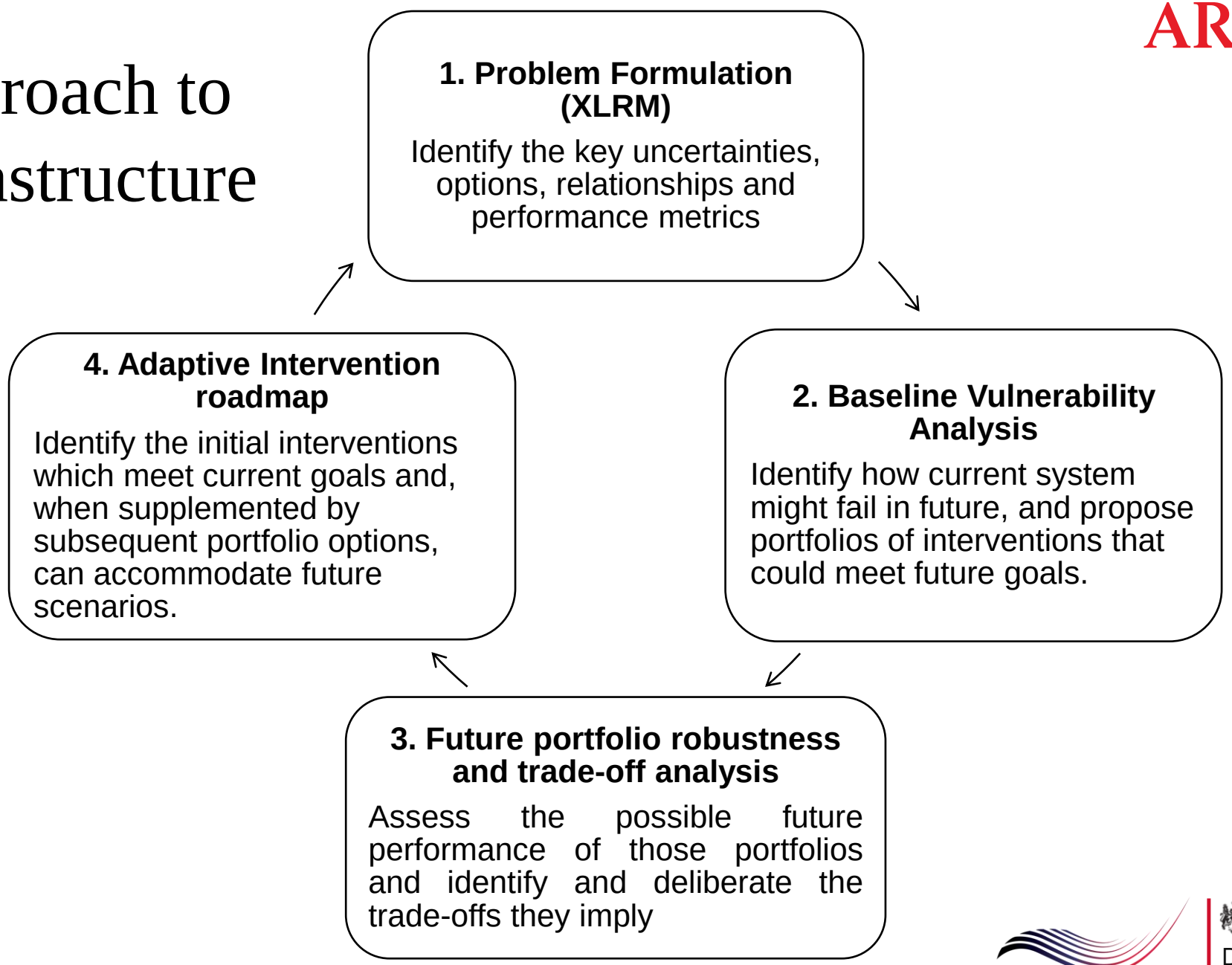
Minimum performance thresholds to identify promising packages of options



Roadmap – adaptive pathways



Resilient approach to national infrastructure investment



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Other large-scale applications

WATERSTRATEGY.org

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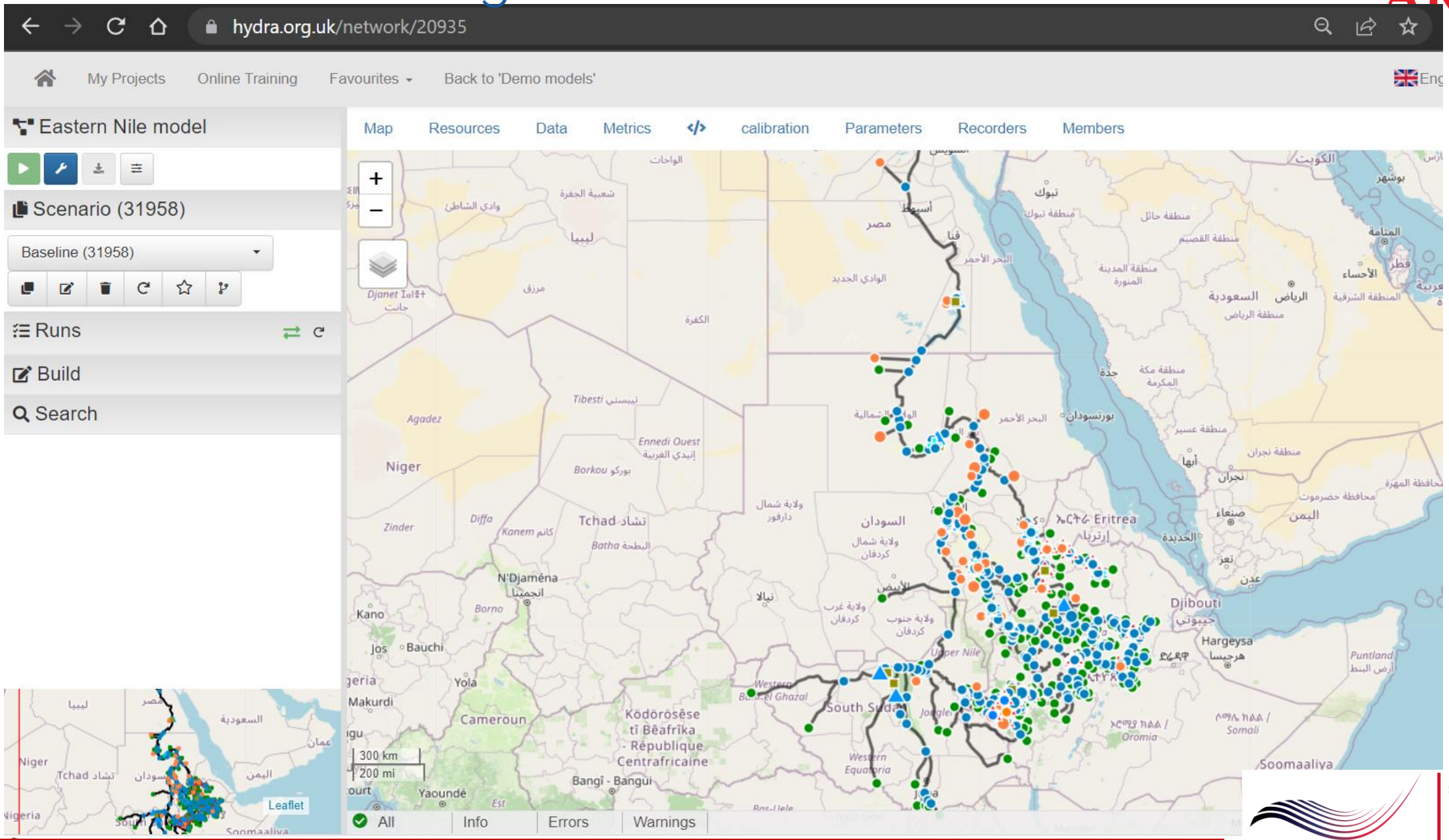

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WATERSTRATEGY.org

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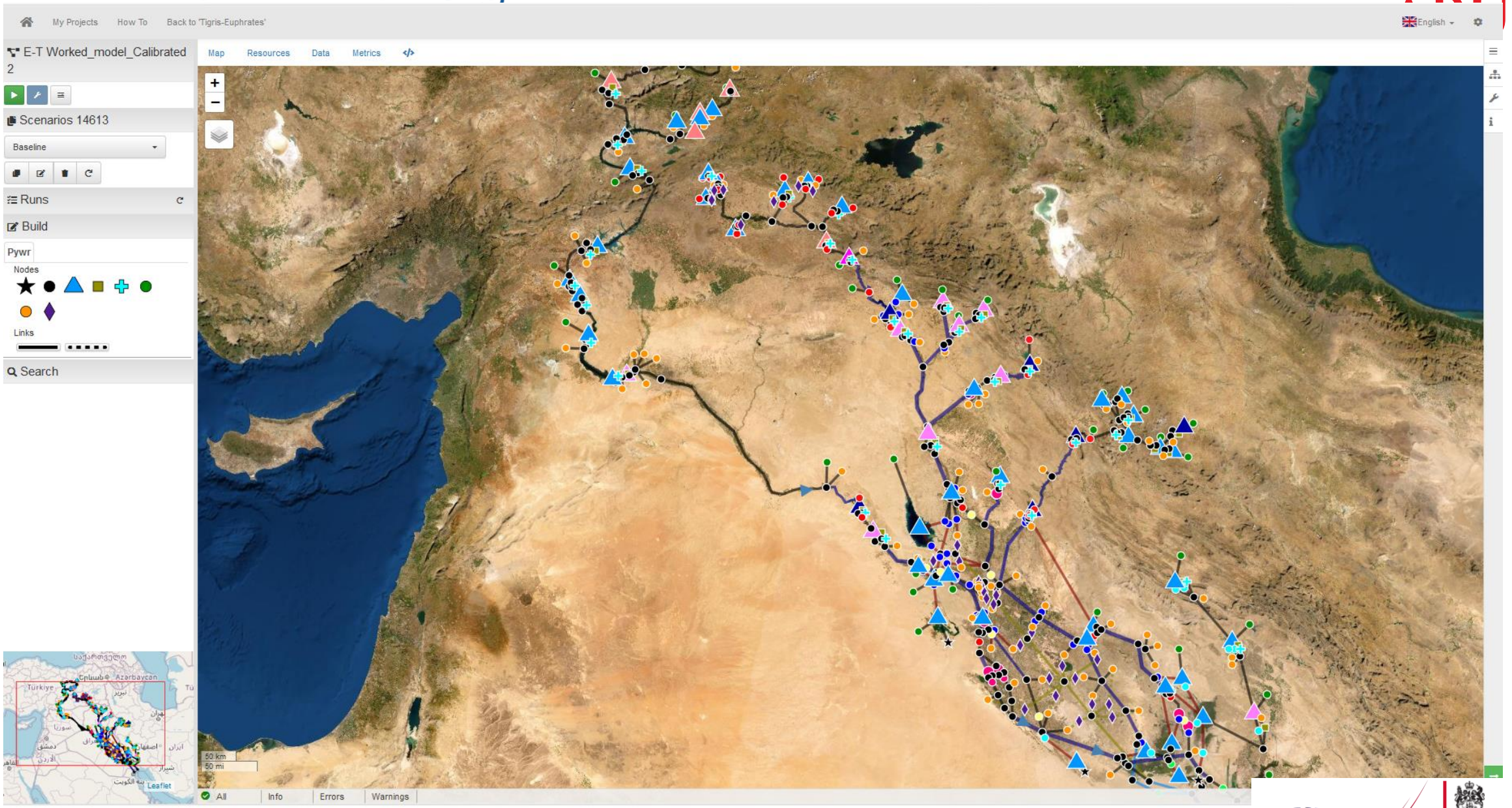

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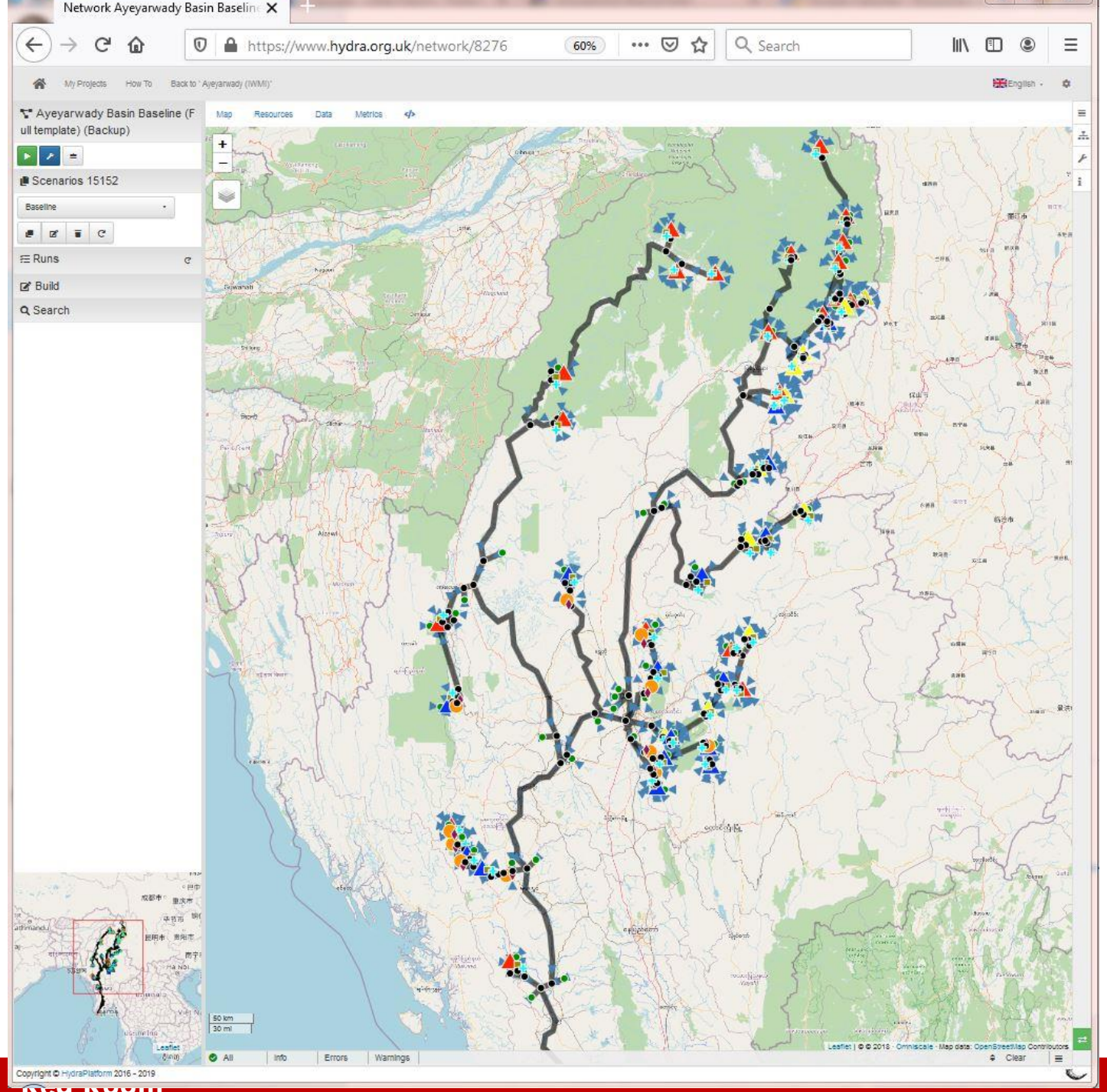

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Myanmar national water infrastructure assessment

WATERSTRATEGY.org

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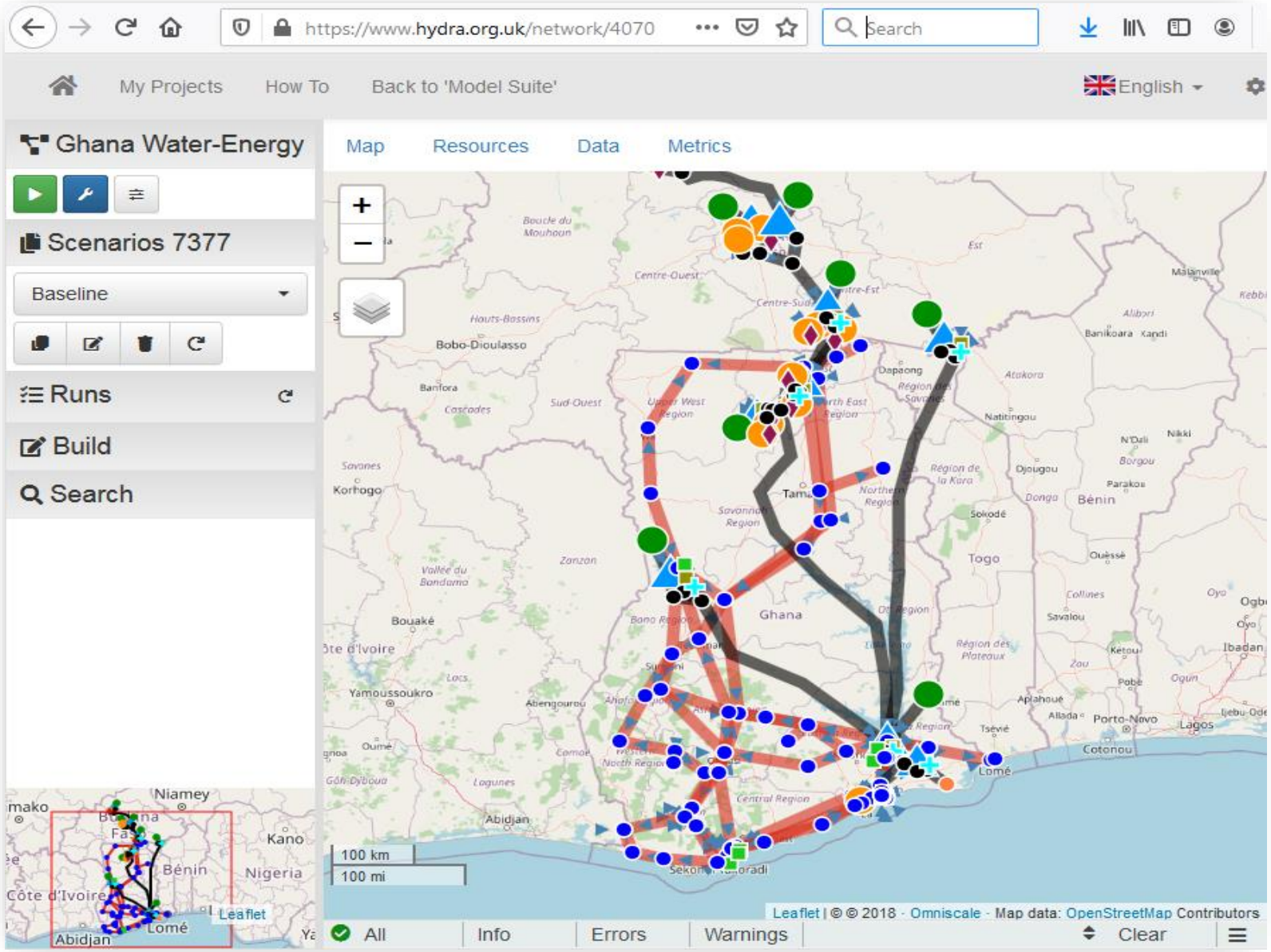

Ghana water-energy design

WATERSTRATEGY.org

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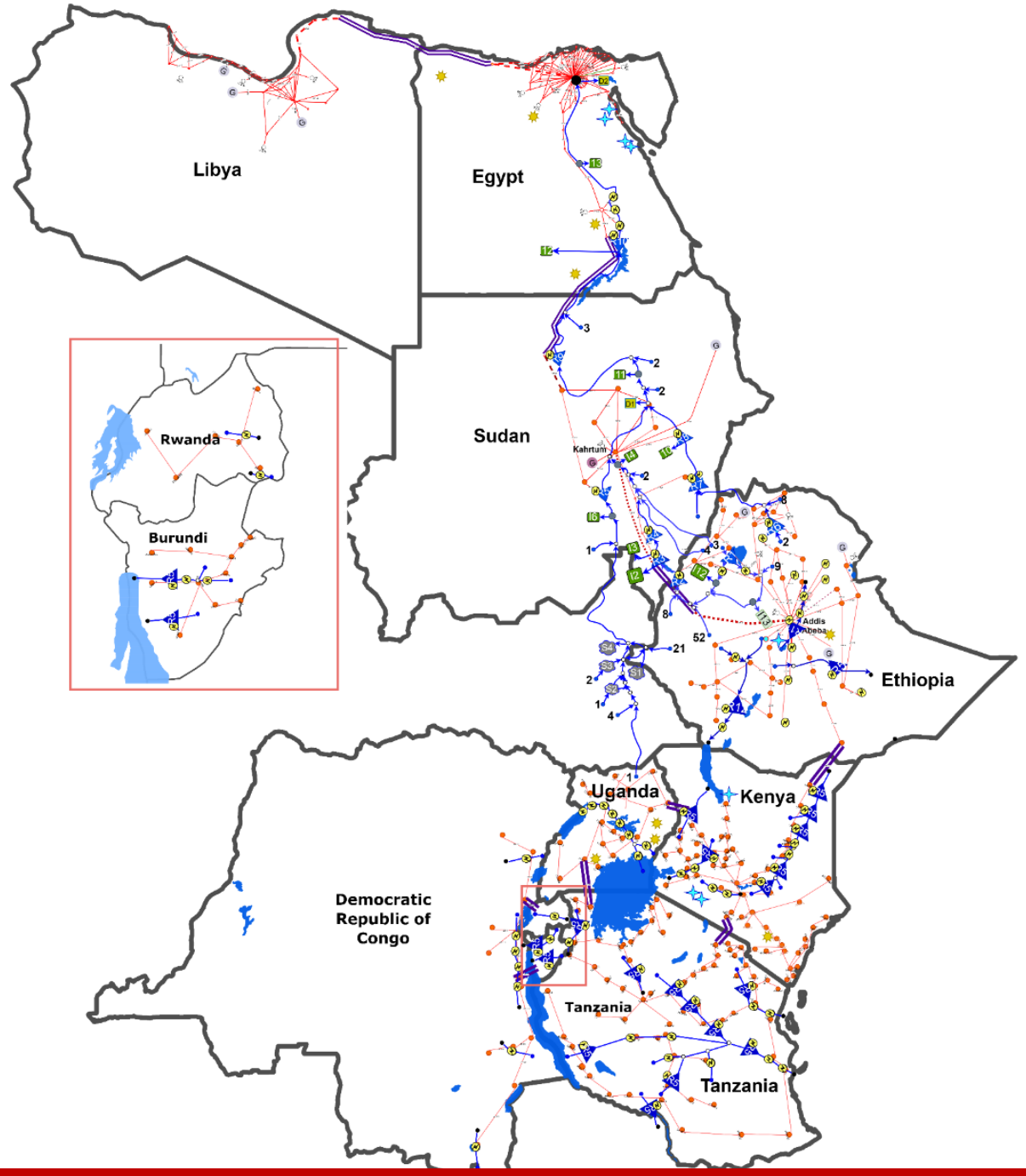
East Africa water-energy design



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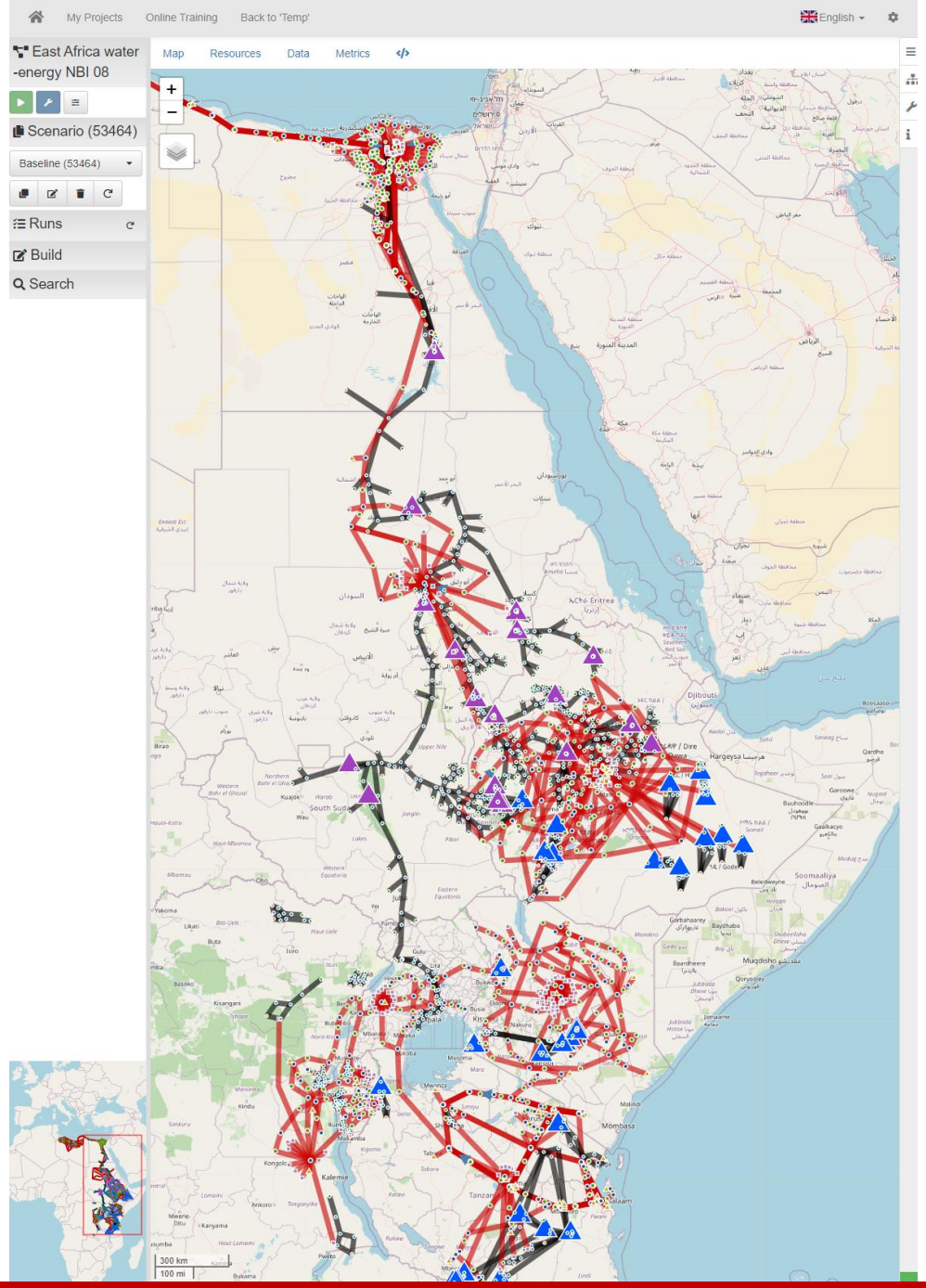

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East Africa water-energy design

WATERSTRATEGY.org

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Julien Harou

jharou@nexsys-analytics.com

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Nexsys analytics

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3
Flood Management

Managing Flood Risk

Mitigating monsoon impacts in West Africa
Supporting Flood Management in India
UK CEH

Dr. Steven Cole
Principal Scientist

scole@ceh.ac.uk

UK Centre for
Ecology & Hydrology

UK Centre for Ecology & Hydrology

Managing Flood Risk

Dr Steven Cole
(plus many others),
Group Leader,
Hydrological Forecasting
Deputy Science Area Head,
Hydro-climate Risks

UKWP-DBT Water Resilience Showcase

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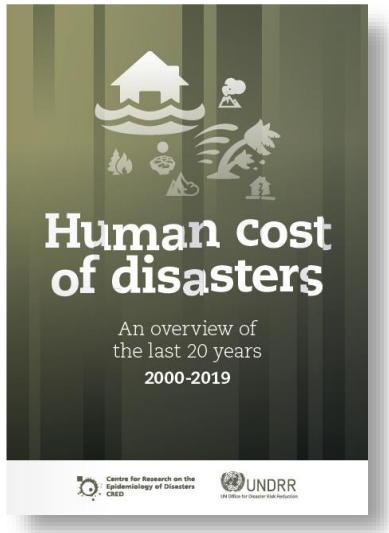
UK Centre for Ecology & Hydrology

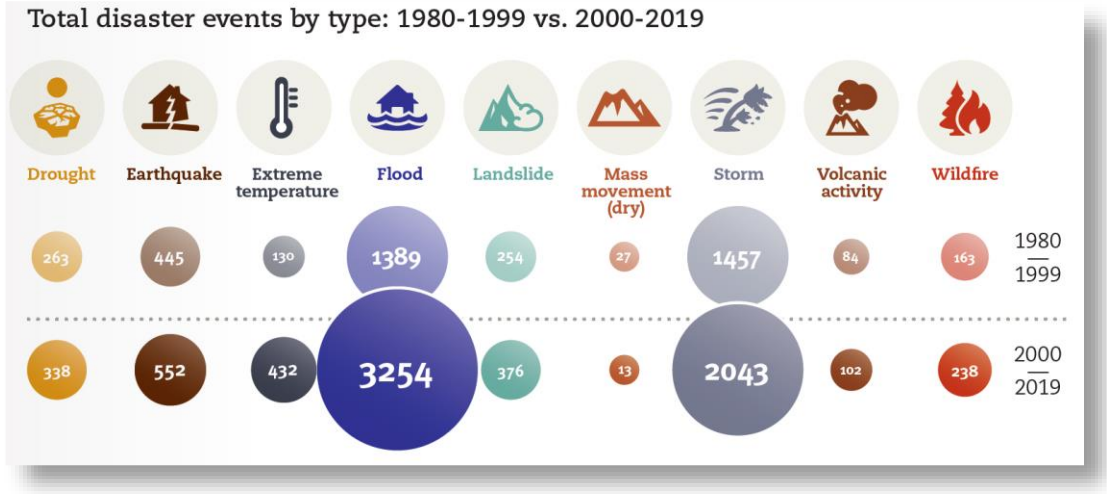
- UK's centre for excellence in environmental science across water, land and air
- Independent research centre – National Capability research partner for Natural Environment Research Council
- Capabilities: research, field surveys, monitoring, laboratories, data management, modelling, impact studies, expert advice & reporting
- Home to 500 scientists, across four UK sites
- 120 water specialists: hydrologists, ecologists, water chemists, laboratory & field technicians… working on rivers, lakes & wetlands
- Responsible for: National River Flow Archive, UK National Hydrological Monitoring Programme, COSMOS-UK, Environmental Change Network, etc.

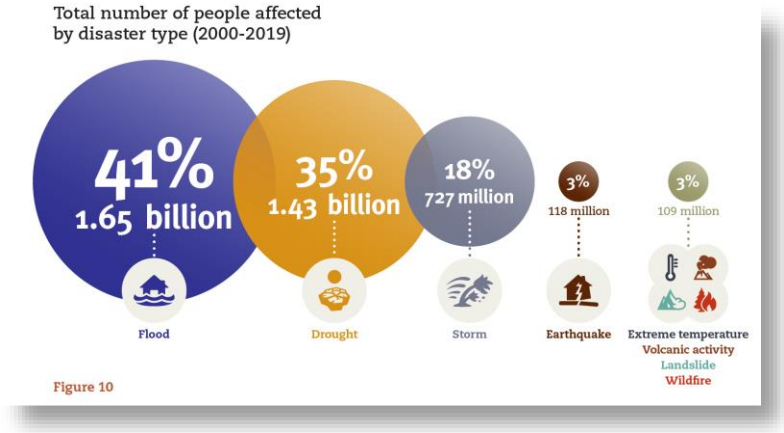
UK Centre for Ecology & Hydrology

www.ceh.ac.uk

Flood Risk: Global Context





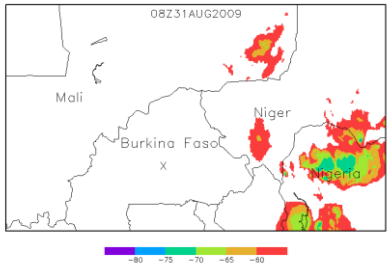


- Number of major floods in last 20 years (3,254) more than double previous 20 years (1,389)
- Floods affect more people globally than any other hazard
- 22% of disaster losses over 2000-19 were due to flooding ($651 billion)

African Monsoon Multidisciplinary Analysis-2050: Objectives and Impact

How will the monsoon change in future decades?

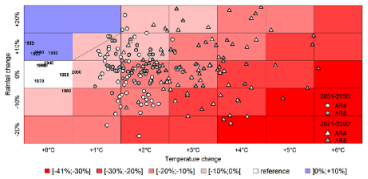
2009 Extreme storm & flooding, Ouagadougou



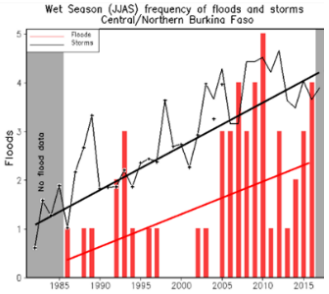
Combining expertise in climate, hydrology, agriculture and social sciences

Co-production of useful climate information & knowledge transfer

Crop yield sensitivity to temperature changes



30 years trend in number of storms and number of floods



- Stakeholder meetings
- Educational theatre forum
- Early Career Researcher Programme

Part of Future Climate for Africa Programme – focus on Sahel, West Africa
4 years, 15 partners UK, France, West Africa

UK Centre for Ecology & Hydrology

www.ceh.ac.uk/our-science/projects/amma-2050

FUTURE CLIMATE FOR AFRICA

UKaid from the British people

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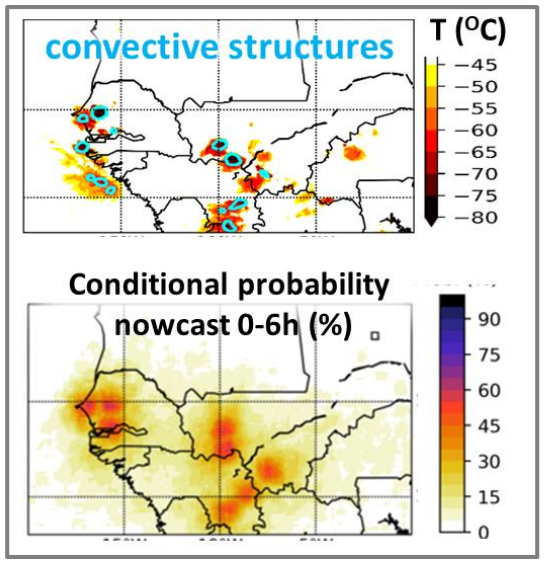
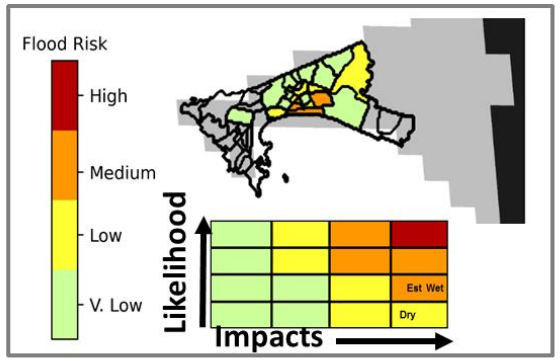
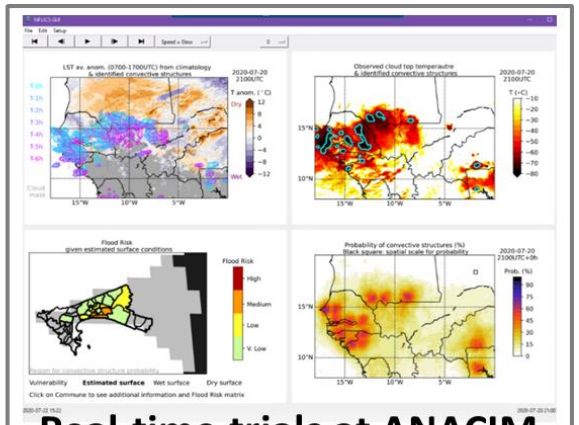
Nowcasting FLood Impacts of Convective storms in the Sahel (NFLICS)

Co-development of warning products and communication strategy
Engaged with recipients of warnings – what information needed and how

New satellite nowcasting methods → **New rainfall and flood risk products** → **Real-time prototype trial and evaluation**







Real-time trials at ANACIM during rainy seasons

Warning Services

Portal: eip.ceh.ac.uk/hydrology/west-africa/nowcasting/

Rainfall and Flood Frequency in India for Flood Management

Understanding rainfall and flood frequency (e.g. 100 year flood) is key for managing flood risk

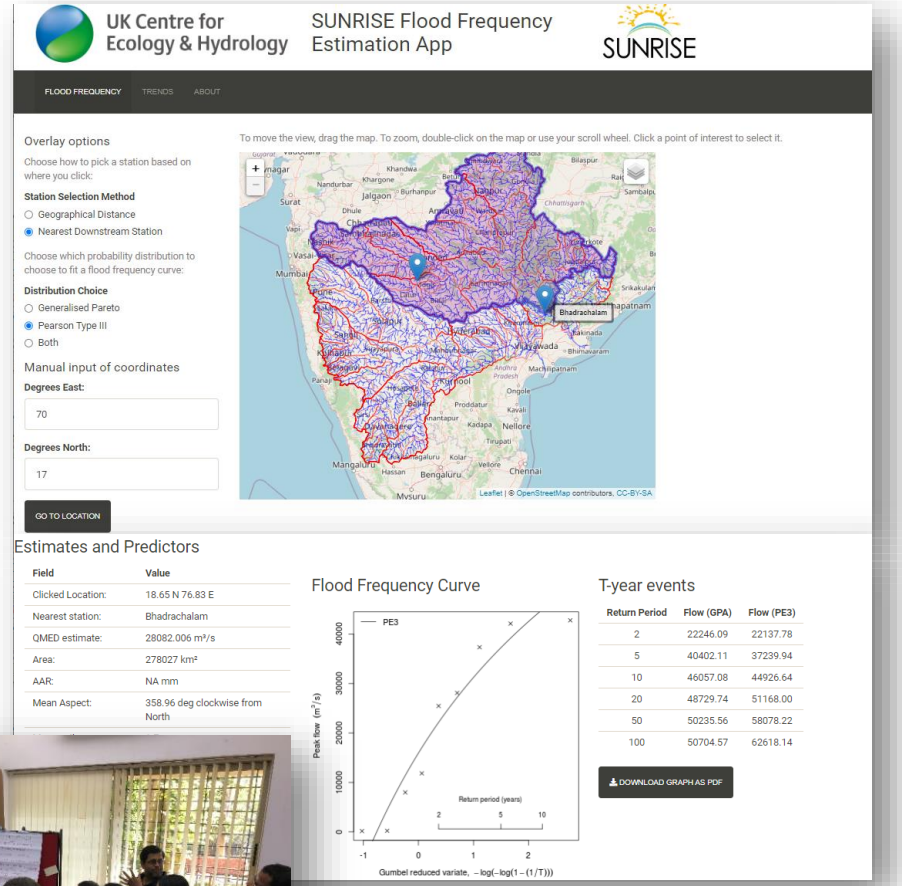
Built on UK-based methods (Flood Estimation Handbook) in collaboration with Indian partners

Web-portal created for data sharing

Gridded and point estimates available

Knowledge exchange and capacity building

shiny-apps.ceh.ac.uk/mah-flood-frequency/



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Natural Environment Research Council

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Developing a Flood Hazard Impact Model for India

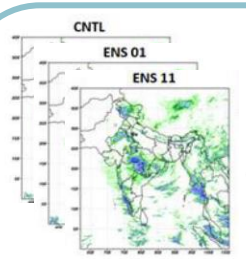
Newton Fund

Met Office

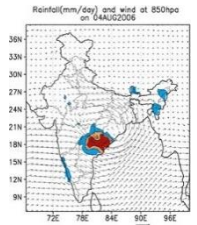
Ministry of Earth Sciences

4 year collaborative project led by UKCEH under UK-India Weather & Climate Science for Service Partnership Programme (WCSSP India)

Rainfall observations and forecasts



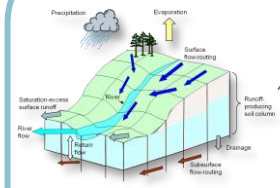
NEPS-R ensembles **NCMRWF**



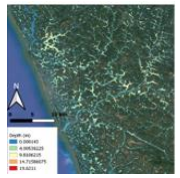
Observations **IMD**

Flood modelling

Flood models



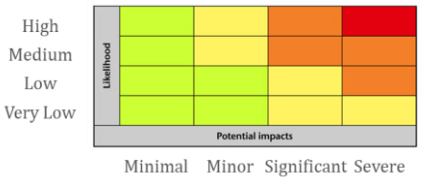
G2G ~1km flood **UKCEH**

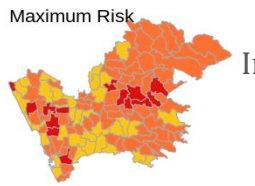


HiPIMS ~30m flood **Loughborough University**

Risk modelling

Automated flood impact and risk products





Impact & Risk **HSE**

- Impact-based Forecasting (IbF) method aligned to World Meteorological Organisation guidelines
  - ➢ Risk Matrix approach that combines uncertainty ***and*** impacts ⇨ ENSEMBLES
  - ➢ Co-develop and evaluate across UK/India partners

UK Centre for Ecology & Hydrology

UNIVERSITY OF BIRMINGHAM

Loughborough University

HSE

NCMRWF

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Department for Business & Trade

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Any questions?

Steven Cole (scole@ceh.ac.uk)

UK Centre for Ecology & Hydrology

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4
Water Scarcity

Managing Water Scarcity

Ensuring long-term security of water supply in Oman

Matt Macdonald

Richard Noakes
Technical Director

Richard.Noakes@mottmac.com

MOTT MACDONALD

MOTT MACDONALD

Managing water security in Oman and Bangladesh

Oman

Security of potable water supply

Bangladesh

'Blue Gold' Water and food security in coastal zones

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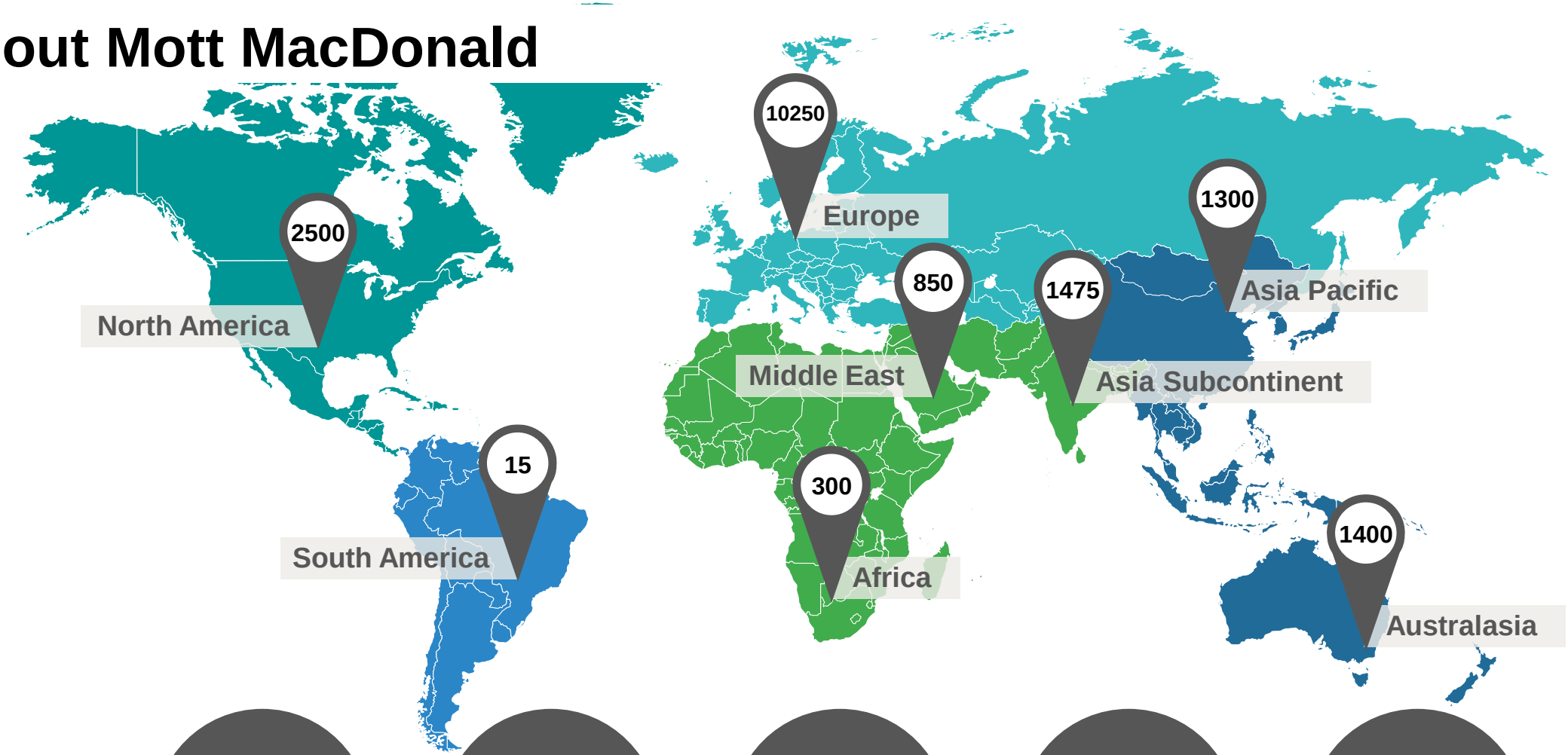
About Mott MacDonald



We work in 135 countries

170 permanent offices in 50 countries

18k staff

$2 billion turnover

Over 150 years' heritage

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Oman's need

The problem

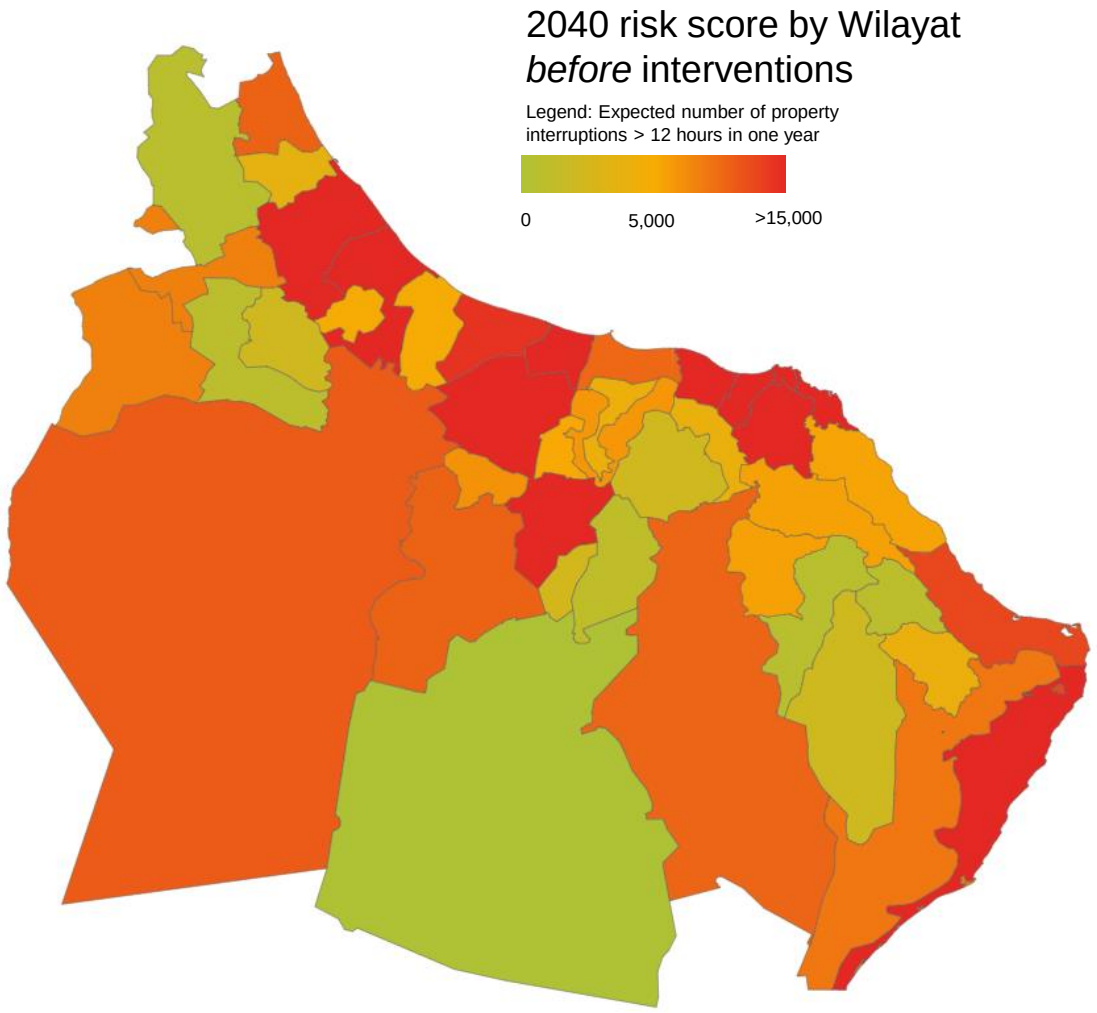
- An arid country – 85% desalination
- A fast developing country
- A well planned integrated system crossing the mountains
- What is the risk to customers, wherever they are?
- How can it be mitigated ?
- What cost to benefit?

Scope

Most of Oman's water system from the sea to customers

- Marine environment
- The pipeline and storage system
- Aquifers & wellfields

The outcome – a decision support tool



1

Decision support tool

A quantified geographical representation of risk

2

Advice on key 'control measures'

Policy and strategic measures to reduce risk

3

Priority investments list

Optimised for maximum benefit

The Bangladesh ‘Blue Gold’ Programme

Water Management for Development
An inclusive approach to water security and improved water management.
800,000 farmers in four coastal districts

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Red Room

Blue Gold Program: outputs

Improved infrastructure

In-polder water management and water management partnerships – making the best use of water

Towards commercialisation of agriculture
with production systems of higher productivity and profitability

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MOTT MACDONALD

Thank you

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5
Water Quality

Water Quality Modelling

Developing a Water Quality Monitoring Programme

WRc

Dr. Austen Buck
Principal Consultant of Microbiology

Austen.Buck@wrcgroup.com

wrc
creating a better tomorrow

creating a better tomorrow

Department for Business & Trade

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Water Quality

Dr Austen Buck CSci MIWater

Principal Consultant – Microbiology and Water Safety Planning

June 2023

UKWP-BBT Water Resilience Showcase

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Red Room

About WRc

We are **dedicated staff with a range of skillsets** who care about delivering a **positive legacy in partnership** with our clients.

Our priority is **creating a better tomorrow** through helping to solve problems with technical expertise and innovative solutions.

creating a better tomorrow

6 CLEAN WATER AND SANITATION

Our work as **consultants and service providers** supports the achievements of the United Nations Sustainable Development Goals (SDGs).

We are **focused on doing the right thing** – protecting the environment, reducing our carbon footprint and that of our clients, and above all ensuring safe, healthy, populations and habitats.

This is achieved through demonstrating our core values: underpinning our **trusted, innovative solutions** with **technical excellence** and **independence** of thought.

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Water Quality Service Offerings

Development and review of water quality **monitoring programmes** across the water cycle

Raw water quality **modelling and management**

External audit and investigations of water quality sampling and **laboratory operation** against ISO 17025 and other standards

Quantitative Microbial Risk Assessment

Development of water safety plans across the source-to-tap system and beyond

External audit of water safety plans against WHO guidance and BS EN 15975-2

Water Quality Service Offerings

Development and review of water quality **monitoring programmes** across the water cycle

Compliance

Risk

Operational

	Source	Abstraction	Treatment	Storage	Customer
					
Compliance	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic
Risk	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic
Operational	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic	Microbiological Chemical Radiological Physical Organoleptic

Source Abstraction Treatment Storage Customer

Compliance

Risk

Operational

Microbiological
Chemical
Radiological
Physical
Organoleptic

Parameters	Frequency per annum
Coliforms	365
E. coli	365
Nitrate	12
Iron	52
Organic Carbon	52
α & β radiation	4
Turbidity	365
Taste and Odour	365

Case study – Using recycled wastewater for district cooling systems

Developing a monitoring programme for public health risk assessment

Client Challenge

Client wanted to assess feasibility and microbiological safety of using recycled wastewater in the countries district cooling systems.

Objectives

Developed a Medical Review Plan which explored all international regulations related to this practice and we have developed a WQ monitoring programme to comply with regulations and ascertain level of risk

Compliance

Legionella spp. (Cooling Water Standards)

HPC (Cooling Water Standards)

E. coli (Flushing Standards)

Risk monitoring for QMRA

- *L. pneumophila*
- Adenoviruses (A-E)
- Somatic coliphage

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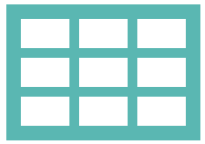


Data Analysis

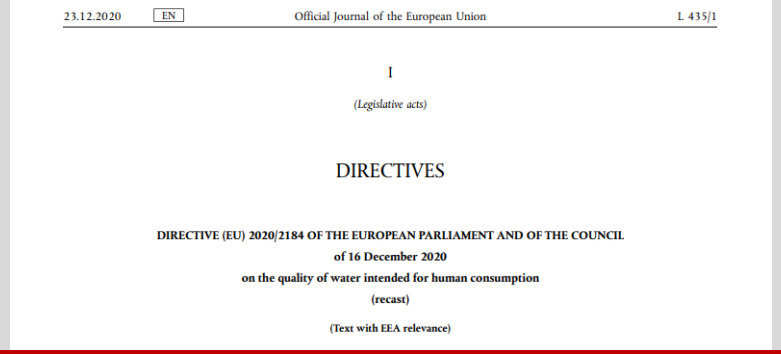
- *Compliance and levels observed*

Quantitative Microbial Risk Assessment

- Theoretical QMRA to be developed
- Will inform level of additional treatment required to use TSE in district cooling systems to ensure public health safety

Some wider global opportunities and challenges

Regulatory change driving WQ stakeholders to monitor for emerging contaminants



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(Legislative acts)

DIRECTIVES

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(recast)

(Text with EEA relevance)

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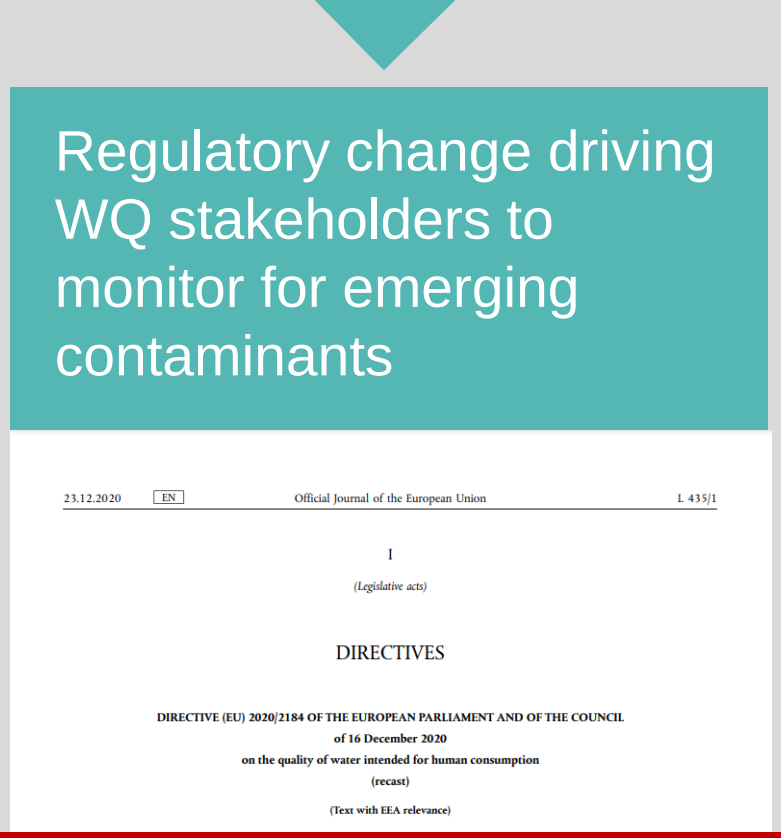

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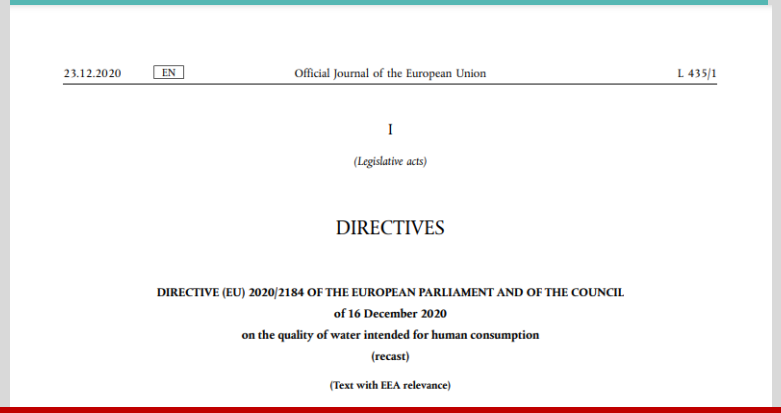

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WHO emphasising risk-based management of water supplies through WSP

Climate change impacting the prevalence and seasonality of WQ risks

Thank you

Whether you are a multi-national corporate, a regulated utility company, a government department, a contractor or an independent technology developer or supplier, our team will work with you to deliver exceptional service and create valued solutions for your needs.

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Trusted globally to deliver innovative sustainable solutions

Swindon | Stirling | Manchester

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Dr Austen Buck
Principal Consultant
austen.buck@WRcGroup.com

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Department for Business & Trade

Red Room

Programme – 30/06/23

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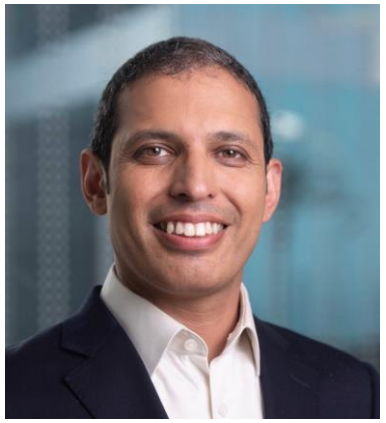
6
Disaster Management: Reconstruction

Reconstruction

Reconstruction with Changes in Peru

Arup



Siraj Tahir
Associate

Siraj.tahir@arup.com

ARUP

PERÚ Autoridad para la Reconstrucción con Cambios

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Foreign, Commonwealth & Development Office

Department for Business & Trade

Rebuilding hope

The UK-Peru Government-to-Government agreement to support the reconstruction of Peru

to support the reconstruction of Peru

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RECONSTRUCTION WITH CHANGES

El Niño weather phenomenon in January 2017 - significant rainfall and flooding

Northern Peru particularly affected

1.1 million people directly affected

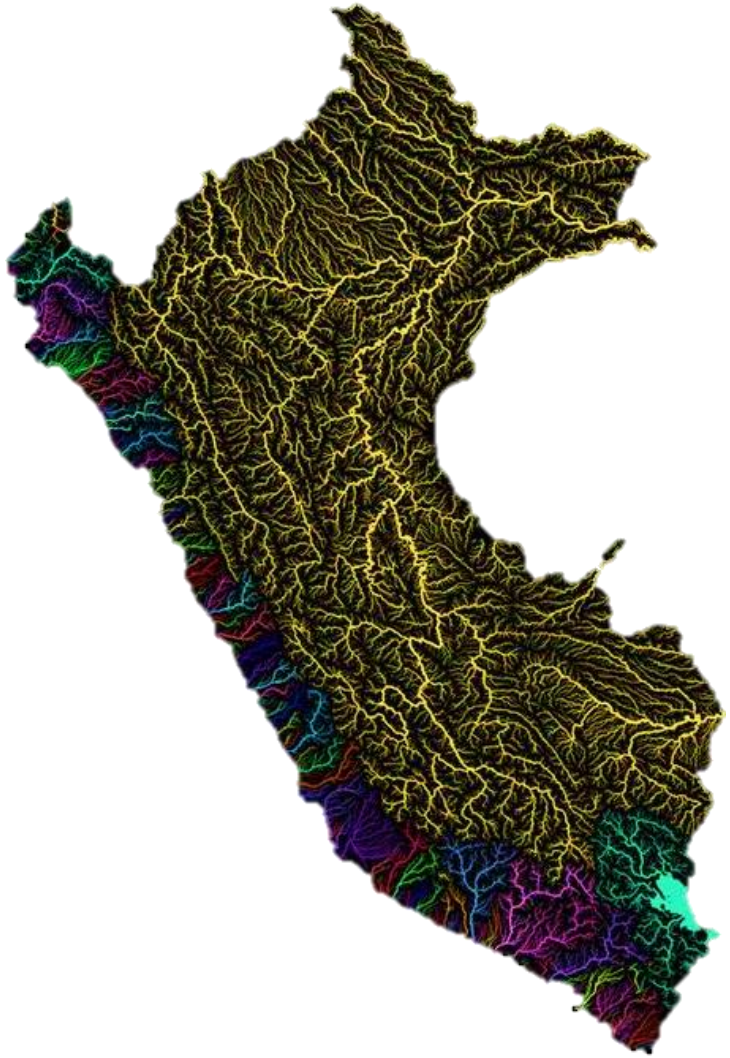
Destruction of hospitals, schools, roads transport links and critical infrastructure

Creation of ARCC to accelerate reconstruction

\‘With Changes' - to improve the quality and reduce future the future effects of El Niño

INTRODUCTION

- G2G Agreement
- UKDT programme approach
- Integrated Solutions
- Benefits, achievements and legacy



A PARTNERSHIP TO ACCELERATE RECONSTRUCTION

HM Government
International Trade Department

UKDT ⟵ G2G ⟶ ARCC

Public bodies

ukdeliveryteam

mace ARUP gleeds

Procurement	Technical assurance
Programme management	Knowledge transfer

Supreme Decree

RECONSTRUCCIÓN CON CAMBIOS

G2G Portfolio

74 educational establishments	15 health centres	17 river basins
5 streams	7 urban drainage	Early Warning Systems

- PERÚ MINSA
- PERÚ MIDAGRI
- PERÚ Ministerio de Educación
- PERÚ MINAM

PERÚ Autoridad para la Reconstrucción con Cambios

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Red Room

UKDT APPROACH

PORTFOLIOS

PILLARS	Integrated solutions	Health	Education
Project control: PMO office, intranet portal, change boards, ...			
Tenders: transparency, NEC3 contracts, evaluation systems			
Technical Assurance: RIBA stages, design guidelines, co-development			
Stakeholder management: holistic approach, monitoring of contractors			
Legacy and learning: beyond infrastructure, 70/20/10, systems			

UKDT PROJECT PORTFOLIO

Tumbes 1

1 river system
1 drainage system
3 schools
Early warning system

Piura 2

1 river system
3 drainage systems
Early warning system
8 health centres
29 schools

Lambayeque 3

5 river systems
1 drainage system
Early warning system
1 health centre
5 schools

La Libertad 4

2 river systems
1 drainage system
Early warning system
1 health centre
5 schools

Ancash 5

3 river systems
Early warning system
7 health centres
24 schools

Lima 6

4 river systems
1 gully
Early warning system
1 health centre
2 schools

Huancavelica 7

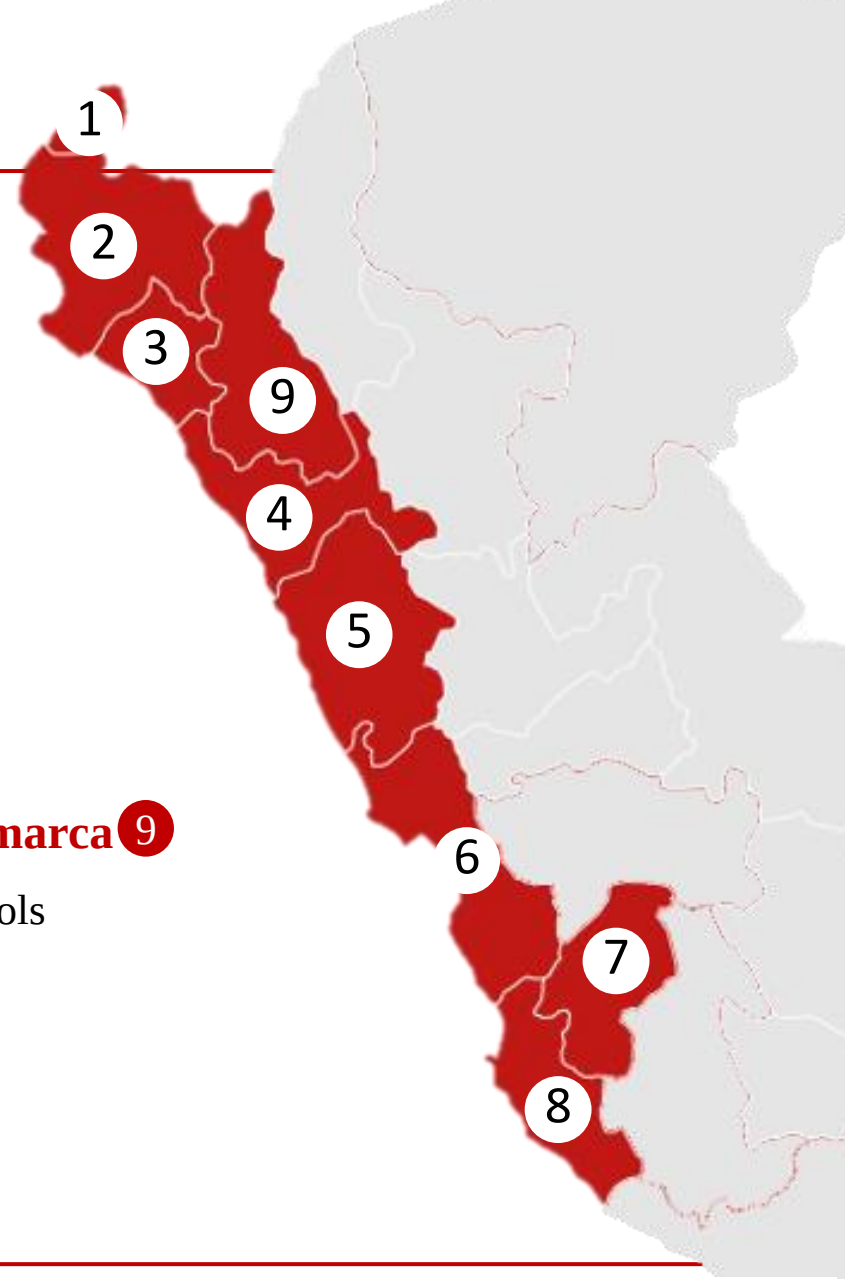
1 school

Ica 8

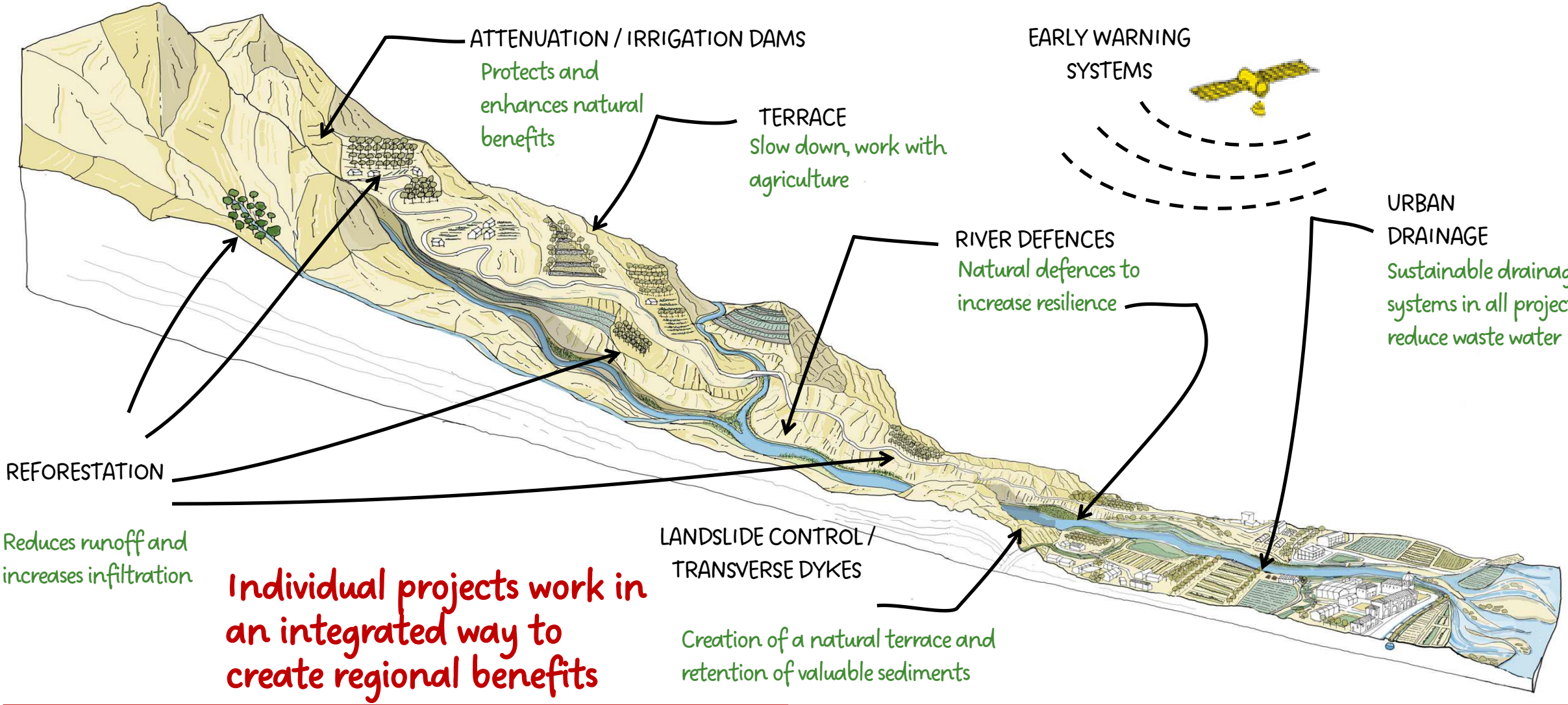
1 river system
1 gully
Early warning system

Cajamarca 9

2 schools



INTEGRATED SOLUTIONS | Enabling Sustainability in a Complex System



Individual projects work in an integrated way to create regional benefits

NATURAL INFRASTRUCTURE

MAIN OBJECTIVES

- Minimising exposure
- Reducing vulnerability
- Building resilience

ADDITIONAL BENEFITS

- Carbon sequestration
- Habitat protection and restoration
- Local non-timber use
- Ecosystem services provided

GREEN INFRASTRUCTURE

- Reforestation / afforestation / revegetation and renaturation
- Forestry management
- Protection and restoration of ecosystems
- Nature-based solutions
- Good agricultural practices
- Local nursery network

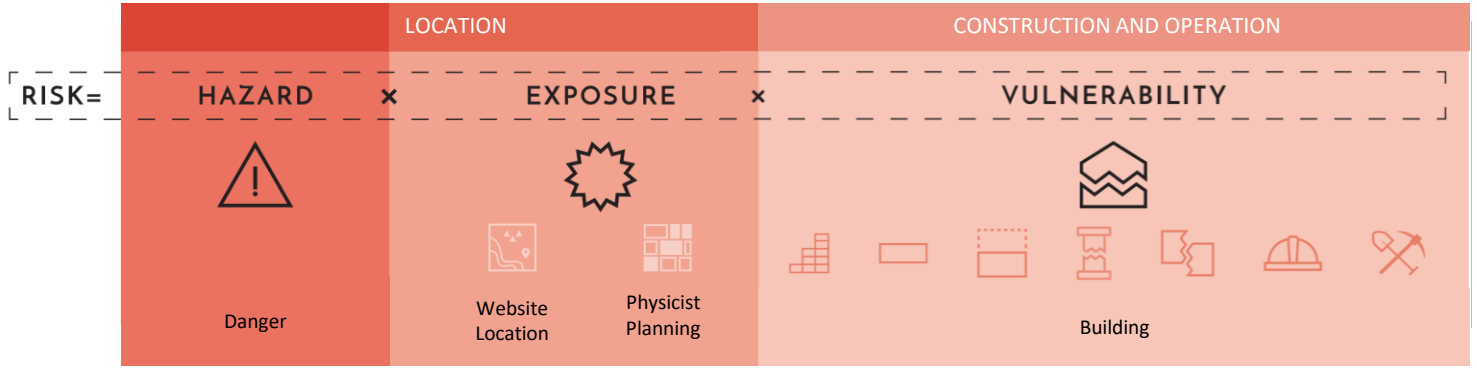
BROWN AND GREY INFRASTRUCTURE

- Terraces
- Infiltration ditches, containment dykes
- Balanced earthworks (global level)
- Improving soil conservation

FLOOD PREVENTION

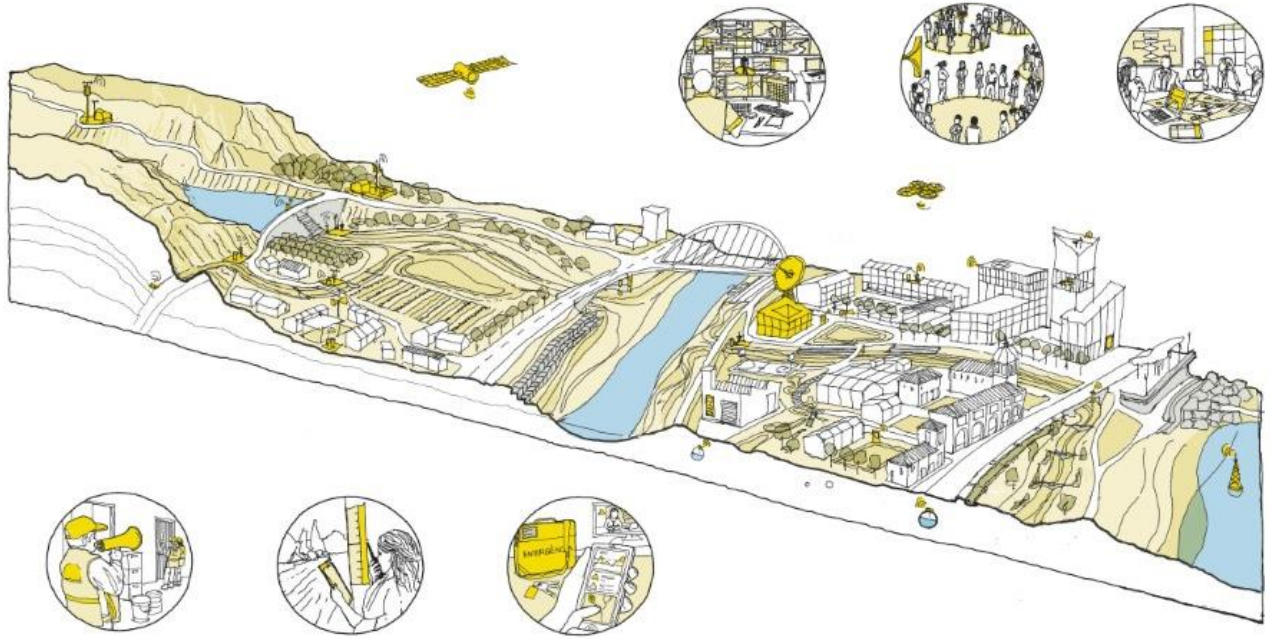
Multi-risk assessment

It is applied to all project sites to determine their feasibility in light of climate hazards and relevant mitigation measures before committing to construction.



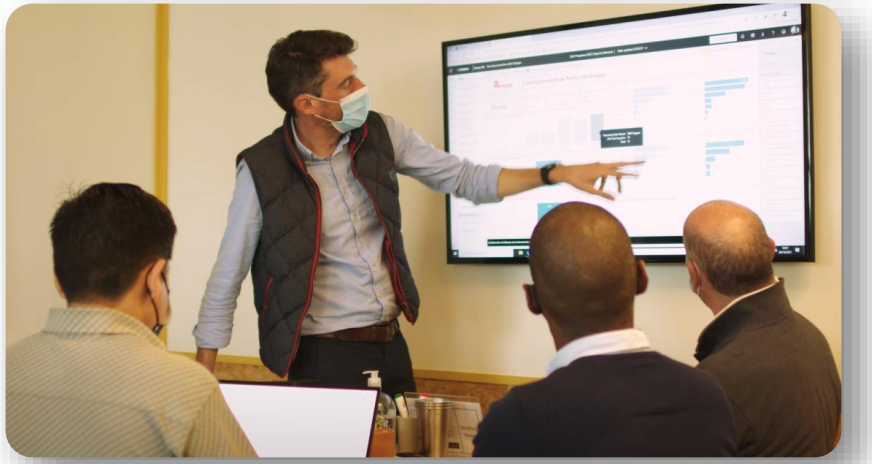
Early Warning Systems

An ambitious and comprehensive Early Warning System that is world-leading in scope and scale. It will help to greatly improve the protection of lives and livelihoods for future generations by equipping communities with warning tools to manage climate response in 17 river basins and 2 ravines.



ACHIEVEMENTS TO HIGHLIGHT

- ✓ ARCC became the **best performing government agency**
- ✓ **Systemic change** in the Peruvian public sector
- ✓ **Pace and transparency** in procurement
- ✓ Increased **national capacity**.
- ✓ 100+ guidance documents + New design Standards
  - ✓ **international best practices adapted** to the Peruvian context
- ✓ 275 formal training modules
- ✓ A legacy of digital **tools** and approaches



BENEFITS OF THE G2G AGREEMENT BETWEEN PERU AND THE UNITED KINGDOM

- **It builds confidence** in the management of mega-projects, institutions and public officials.
- **Fast**, **efficient** and **transparent** procurement process in line with international standards
- **Safe**, **responsible**, **flexible** and **collaborative** construction
- Best practices in **sustainable** and **resilient design**
- Attracting the international market to Peru: **companies**, **technologies**, **best practices**
- A legacy of **knowledge** and **skills** for Peru

> 3.2 billion dollars in infrastructure projects

> 5 million people benefited

> 40,000 local jobs created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CON CAMBIOS
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7

Disaster Management

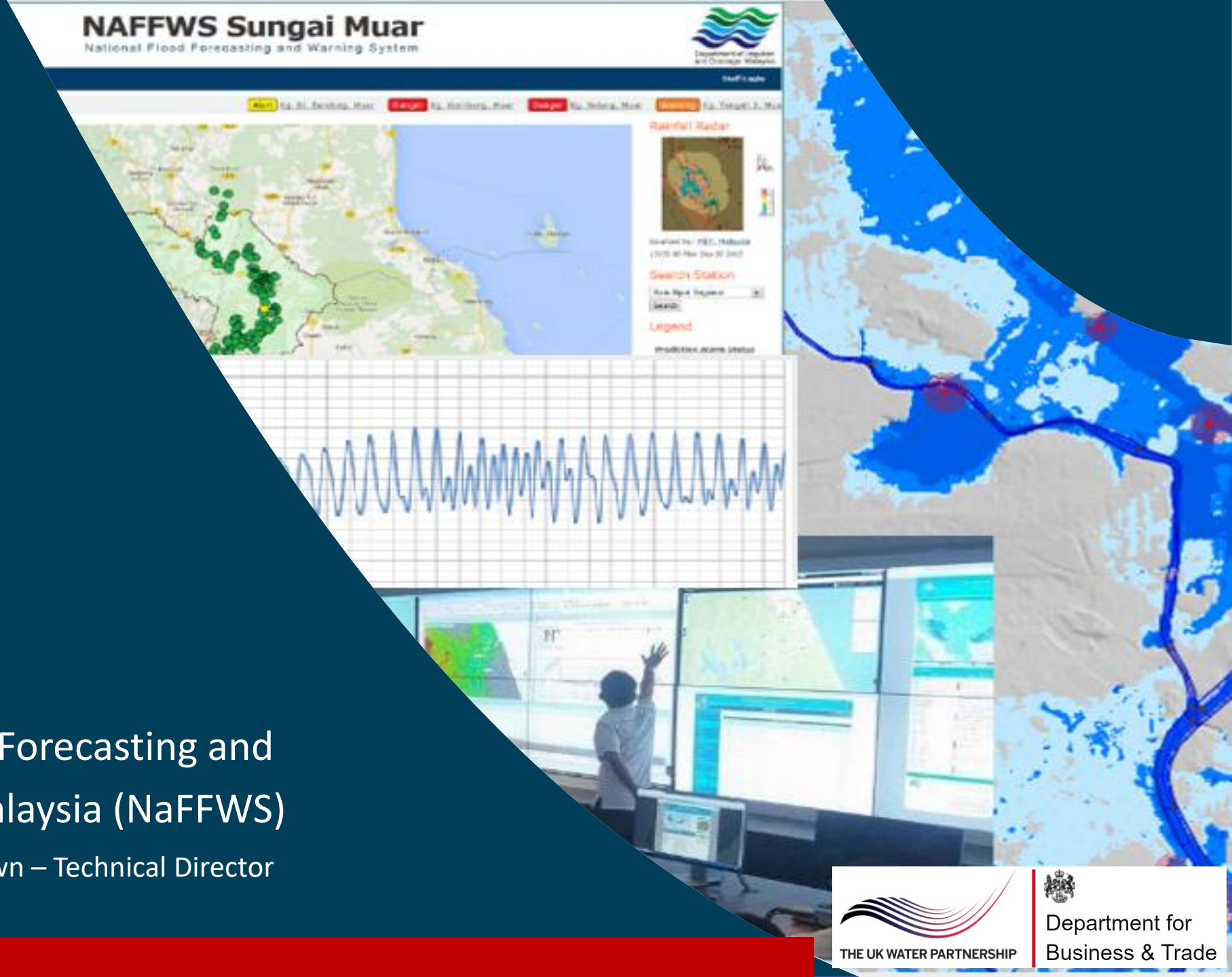
Preparedness

National Flood Forecasting and Warning System for Malaysia (NaFFWS)
Planning for climate resilience in the Caribbean
HR Wallingford

Juan Gutierrez
Global Product Manager

j.gutierrez-andres@hrwallingford.com

hrwallingford



Red room: Module 7 – Preparedness

Case 1: National Flood Forecasting and Warning System for Malaysia (NaFFWS)

Further information: Emma Brown – Technical Director
E.Brown@hrwallingford.com

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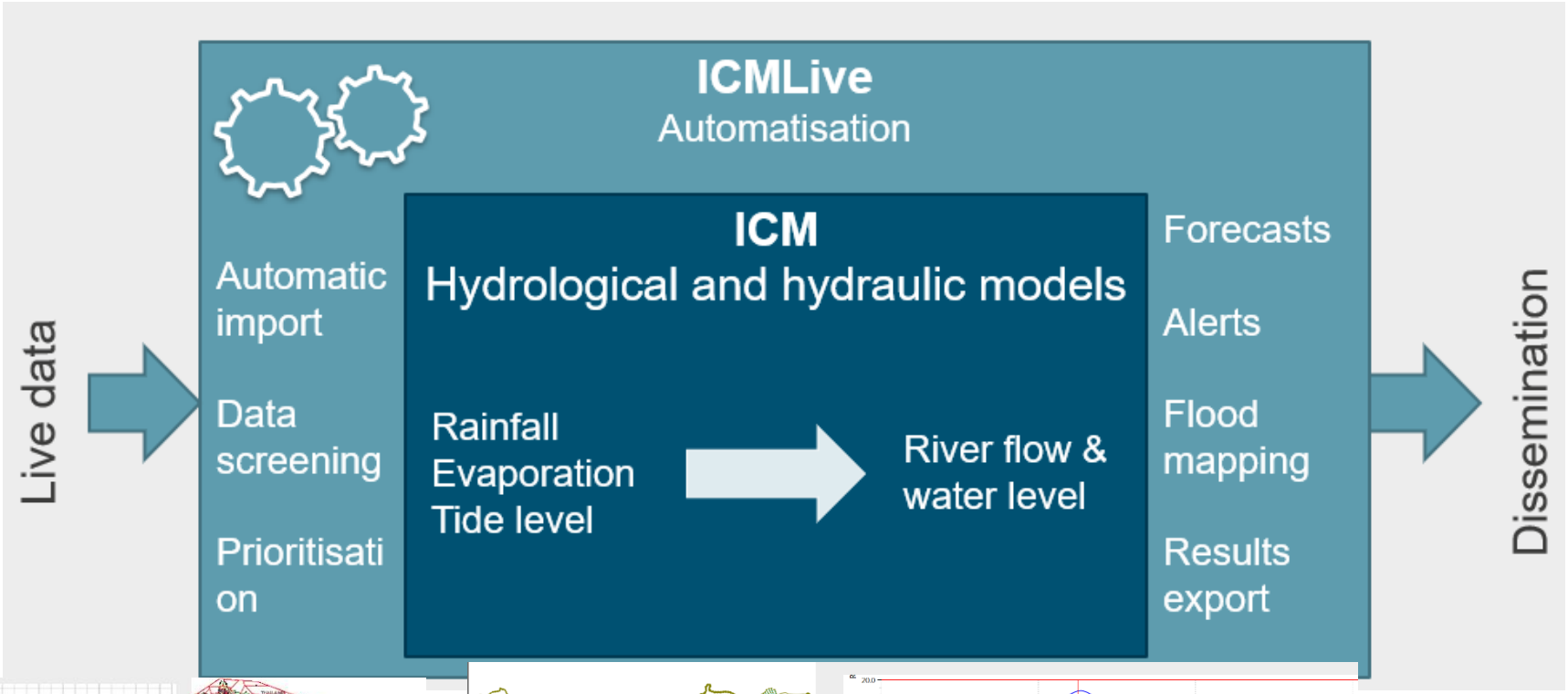
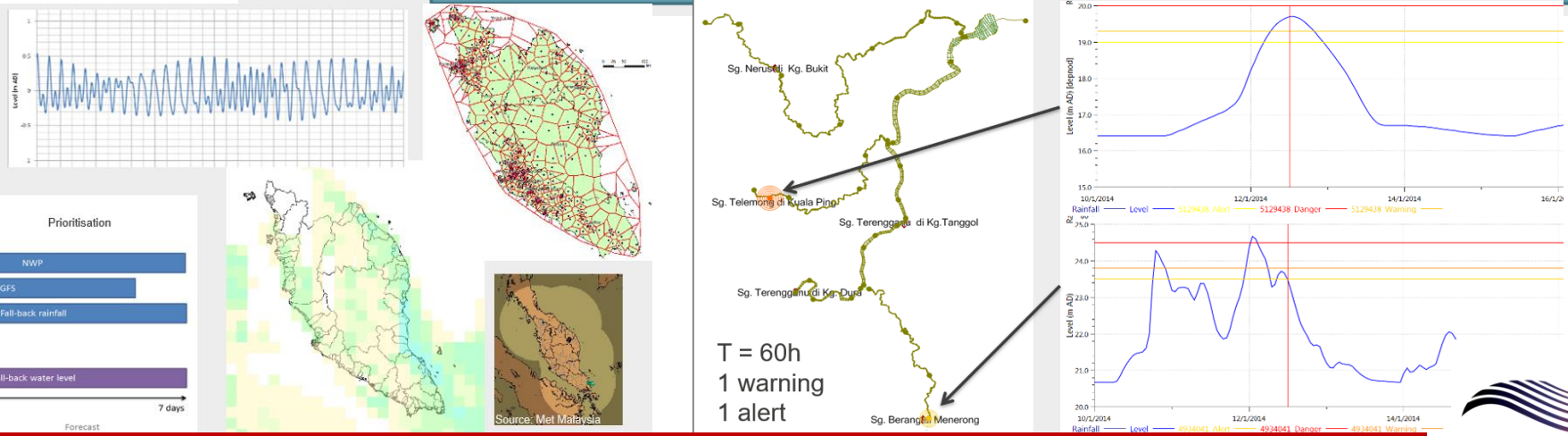
Department for Business & Trade

Background

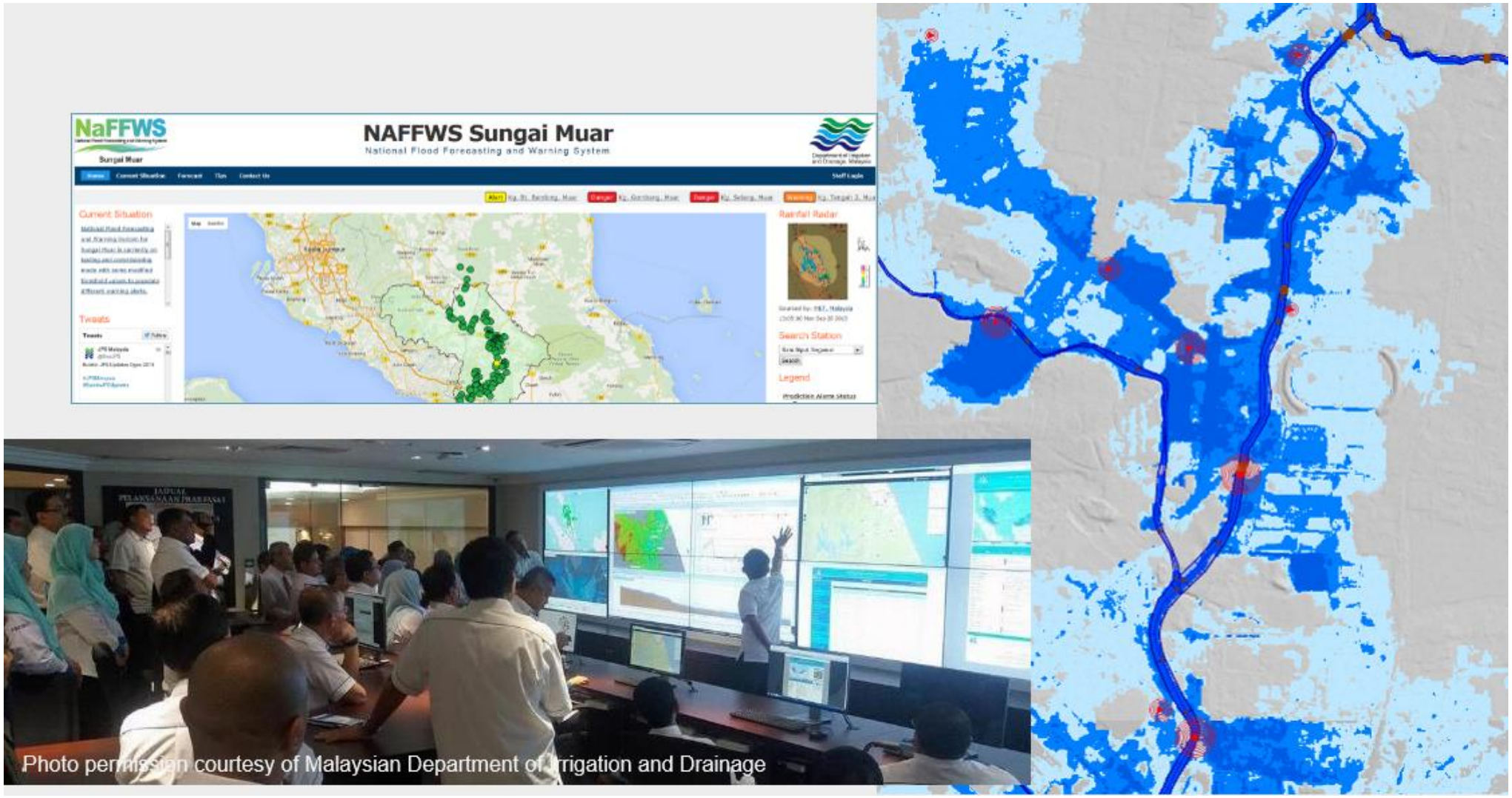
- Across Malaysia, an estimated fifth of the population is at risk of flooding
  - Large areas of the country repeatedly suffer from prolonged, significant floods
  - Widespread disruption for communities, business and critical infrastructure, often requiring evacuation
- Objective of the new NaFFWS:
  - Develop and maintain an integrated flood forecasting and river monitoring system
  - Using national telemetry network data, radar data and various rainfall forecasts
  - With flood warning dissemination

Software: InfoWorks ICM and ICMLive by Innovyze





Dissemination



Further information: Emma Brown – Technical Director
E.Brown@hrwallingford.com

Red room: Module 7 – Preparedness Case 2: Planning for climate resilience in the Caribbean

Further information: Gina Tsarouchi – Principal Engineer
G.Tsarouchi@hrwallingford.com

Project objectives

Objective

- To incorporate drought risks modelling as a planning tool for climate change adaptation measures in Saint Kitts and Nevis

Main outputs

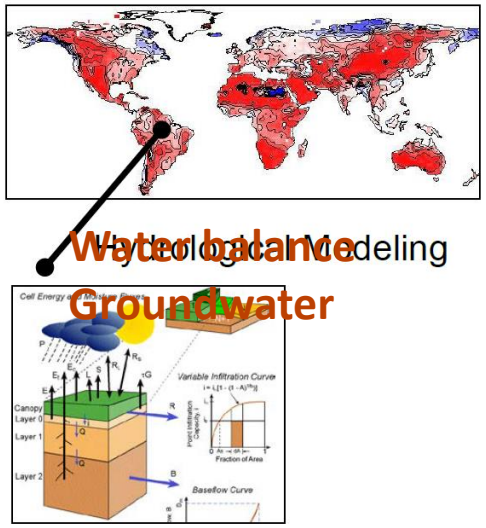
- Implementation of a drought forecasting system
  - Stakeholder working group
  - Capacity building

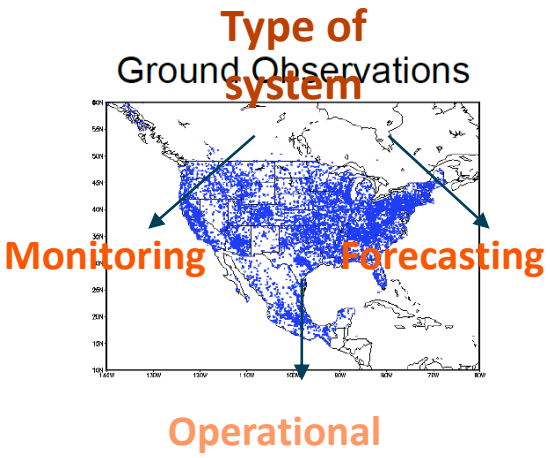
Outcome

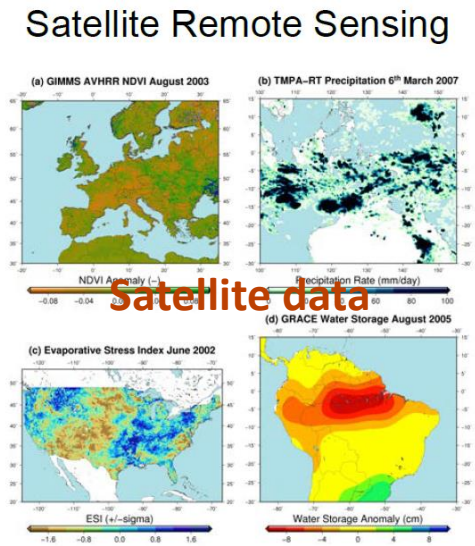
- Increased resilience in the water sector, improved use of water resources, water and food security

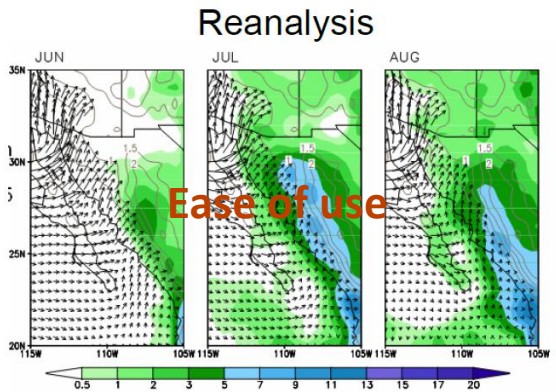
Early warning systems can provide decision makers with timely and reliable access to information on which mitigation measures can be based.

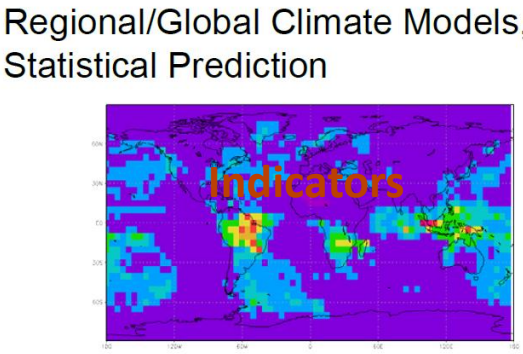
Technical components



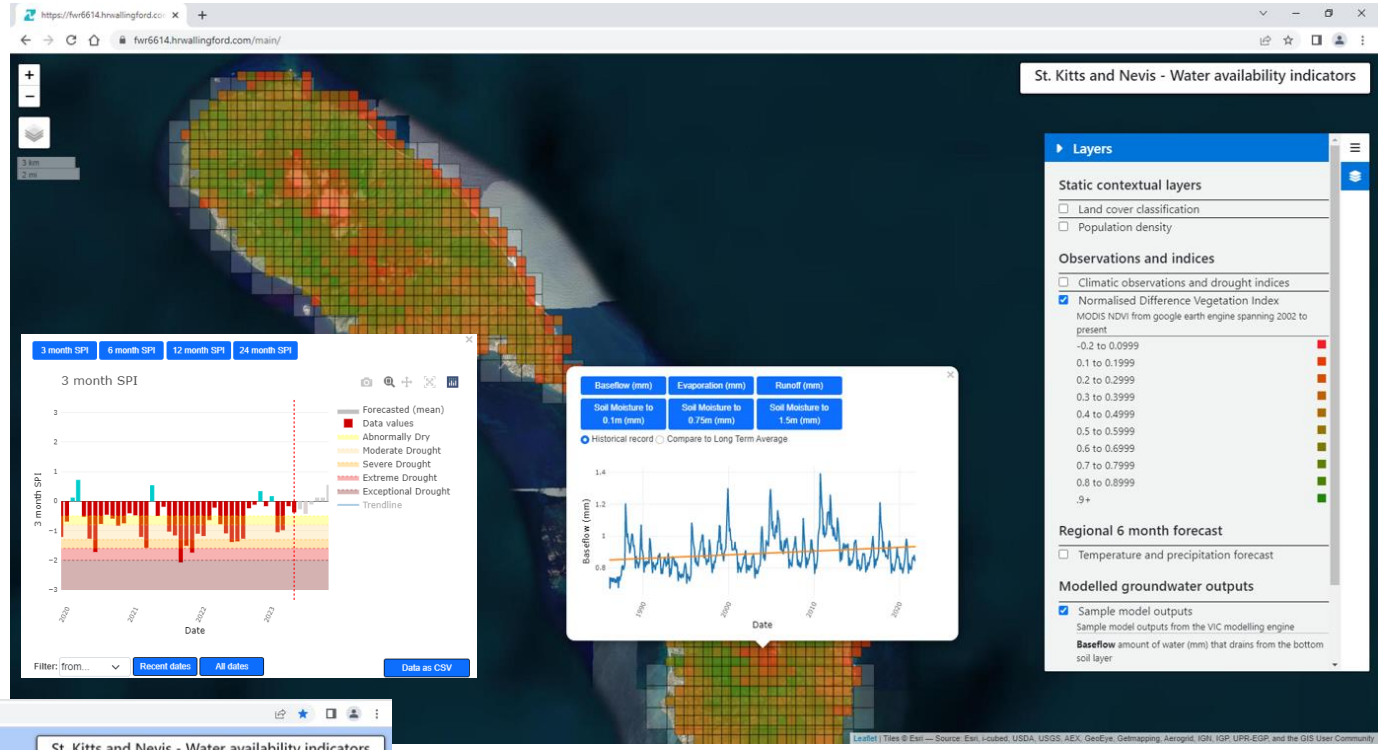


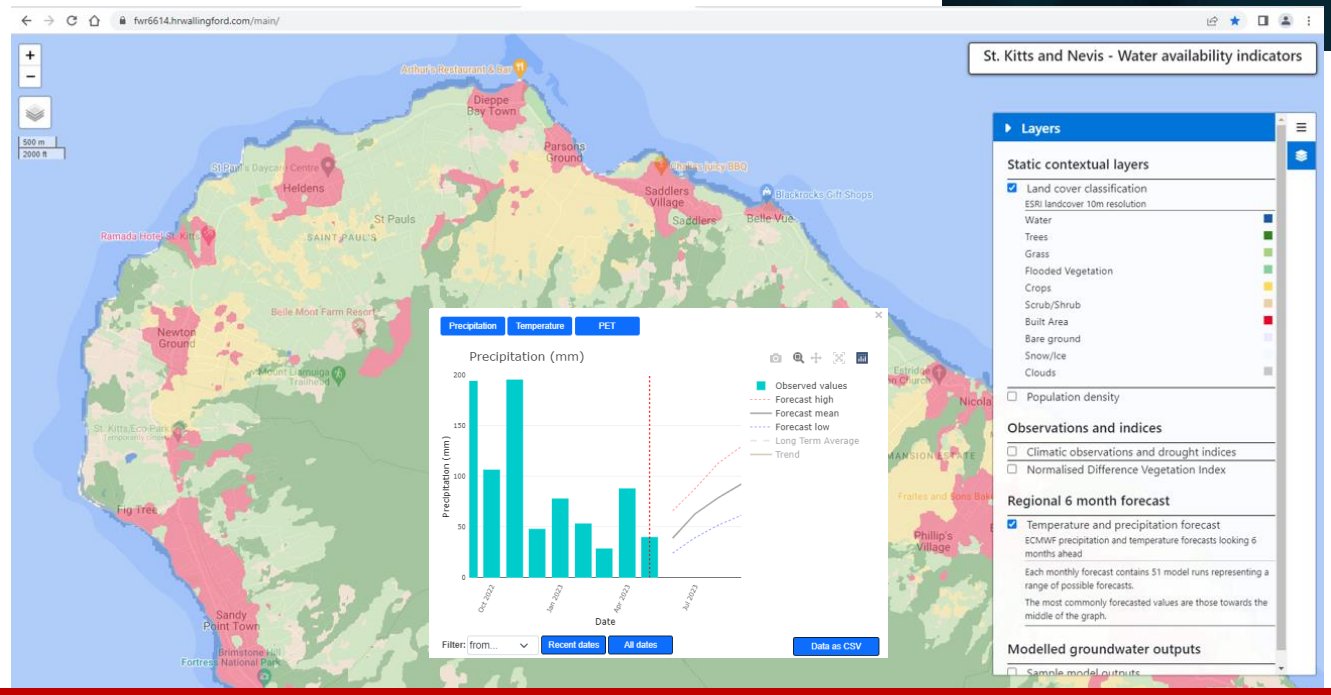






The web-based system





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Thank you for joining us

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UK WATER PARTNERSHIP

Water Resilience Showcase

28 June 2023
30 June 2023

THE UK WATER PARTNERSHIP

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