



WATER FORUM TOWNHALL 2026

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FUTURE OF WATER MANAGEMENT IN MALAYSIA

Challenges, Technology, and Sustainability



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TODAY'S STORY

Where we stand.

What threatens reliable supply.

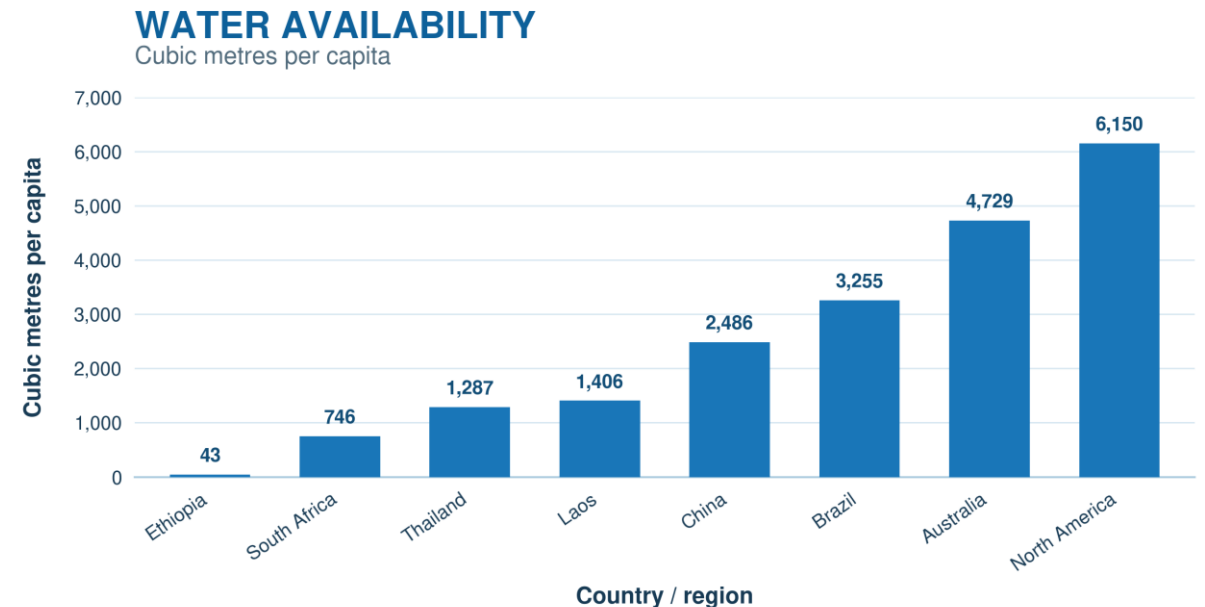
How technology can help.

What Malaysia should do next.

WATER ABUNDANCE

MALAYSIA RECEIVES
A LOT OF RAIN.

“But plenty of rain
does not always
mean reliable water
supply”



Source: Adapted from Grey and Sadoff, “The Global Water Challenge”, 2006

OUR WATER SYSTEMS AT A GLANCE, 2025

Peninsular Malaysia and Labuan



17,417
MLD

RAW WATER EXTRACTION



351

WATER TREATMENT PLANTS



18,932
MLD

DESIGN CAPACITY



8.56
million

CUSTOMER ACCOUNTS



141,873
km

DISTRIBUTION PIPES



16,182
MLD

WATER PRODUCTION

WATER SYSTEM PERFORMANCE IN 2025

Peninsular Malaysia and Labuan – The figures show strengths and warning signs.



WATER SUPPLY COVERAGE

97%

AVERAGE

70–100%

RANGE



RESERVE MARGIN

14.4%

AVERAGE

0–30.2%

RANGE · 6 STATES BELOW 15% TARGET



NON-REVENUE WATER (NRW)

34.3%

AVERAGE · 5,598 MLD

24–62.3%

RANGE · 31–1,439 MLD



PER-CAPITA CONSUMPTION

223 LCD

AVERAGE

85–267 LCD

RANGE · TARGET 180 LCD



DISRUPTIONS

3,165 | 39,845

SCHEDULED | UNSCHEDULED



TREATED WATER QUALITY (QAP)

9/14

STATES SCORED 100%

THE THREATS ON WATER CYCLE

01



Climate

02



Pollution

03



Ageing
assets

04



Demand

05



Behavior

06



Geo-
politics

THE THREATS ON WATER CYCLE

01

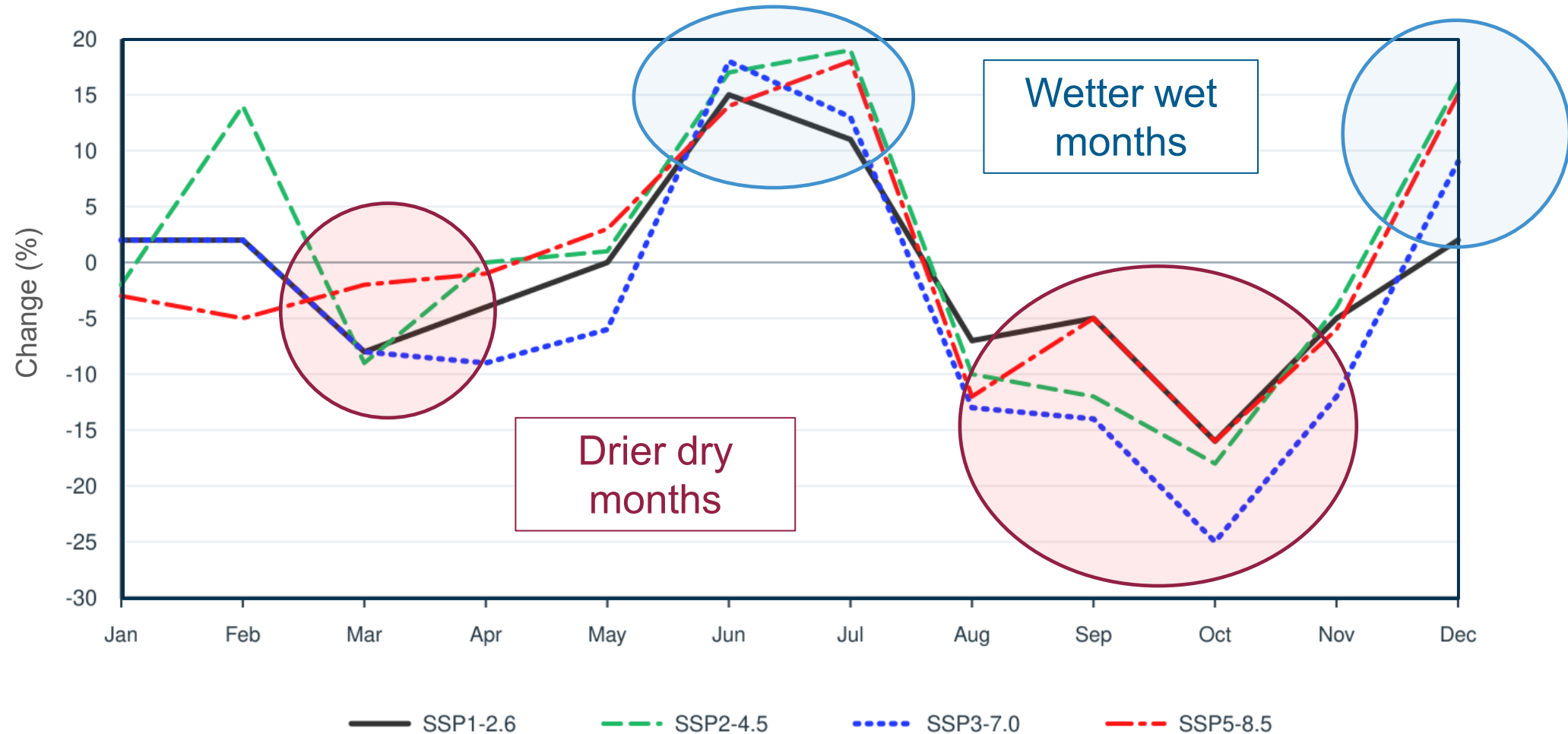


Climate

Longer dry periods reduce water availability. Intense rainfall cause flood, damage intake structure and deteriorate source reliability.

CLIMATE: RAINFALL PROJECTION (2021 – 2060)

Longer dry months and intense rainfall change source reliability



THE THREATS ON WATER CYCLE

02



Pollution

A river pollution incident can stop a treatment plant.

POLLUTION INCIDENTS OF JOHOR RIVER & TRIBUTARIES

Johor River & Tributaries

2013 • Ammonia 2x Palm-oil mill	2014 • Turbidity Sand mining	2015 • Oil Illegal tyre burning	2016 • Ammonia Palm-oil mill; poultry farm
2017 • Ammonia Palm-oil mill; Poultry farm	2018 • No reported pollution	2019 • Turbidity Sand mining • Ammonia Palm-oil mill	2020 • Sweet smell Metal recycling industry • Fertilizer smell Illegal fertilizer dumping
2021 • No reported pollution	2022 • No reported pollution	2023 • Polyglycerols Sludge-oil processing facility • Ammonia 3x Landfill leachate	2024 • Turbidity Former sand mining • Ammonia 4x Landfill leachate

Consequences

Supply disruption.

Higher treatment cost.

Business losses.

Damage to river life.

**Worsened by
climate change.**

Source: BAKAJ

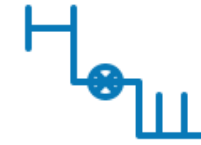
How long can we cope with a prolonged dry period?

Are our monitoring and preventive measures sufficient to safeguard water source from pollution?

Do we have other reliable water sources besides river, when needed?

THE THREATS ON WATER CYCLE

03



**Ageing
assets**

Leaks, ageing pipes and meters raise losses and failure.

WHY TREATED WATER GOES MISSING

Leaks, old pipes and faulty meters waste water and money

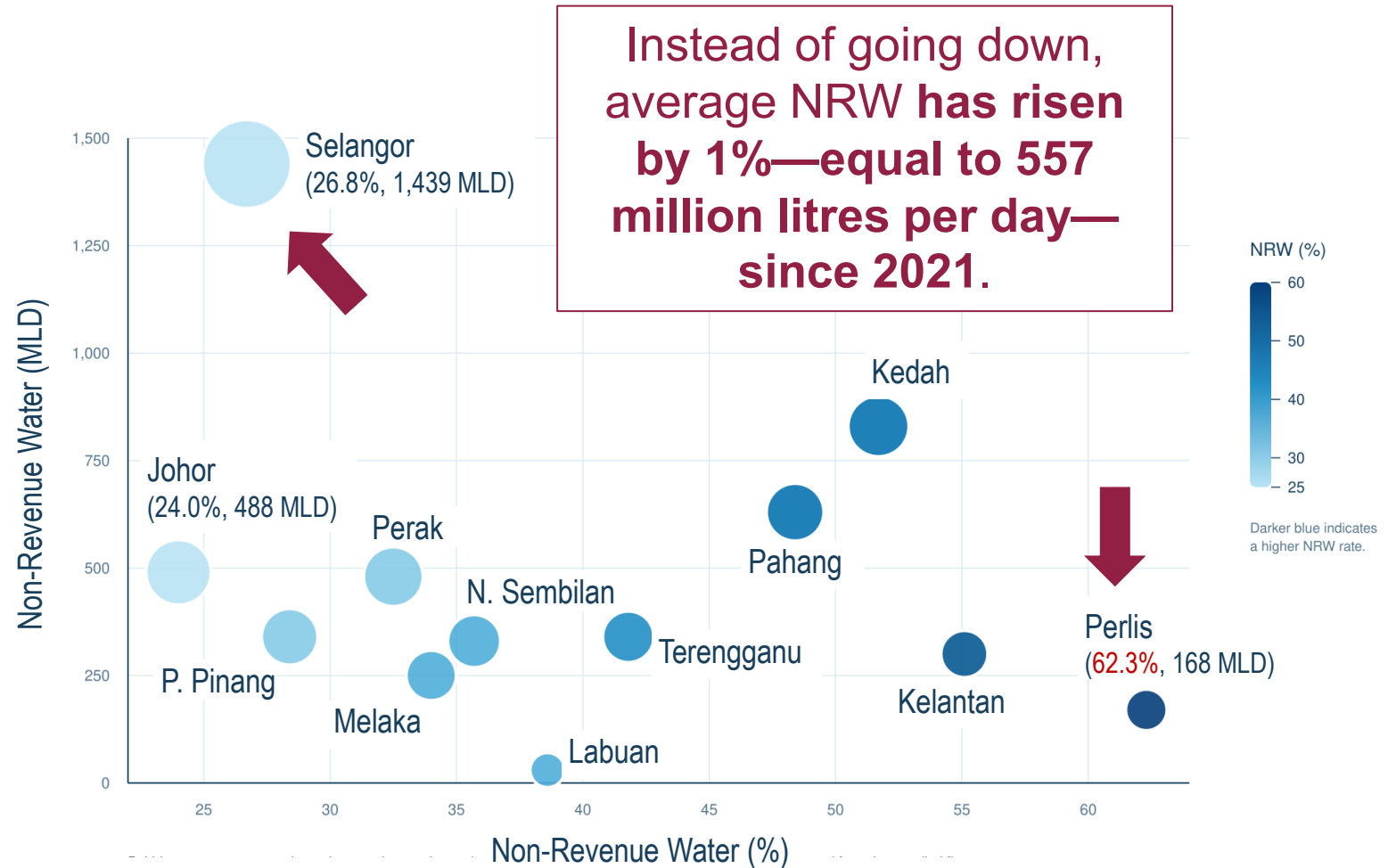
Non-Revenue Water

Treated water that **enters the water-supply system but does not generate income** to the water operator.

Physical losses. Leakage from pipes, tanks and service connections.

Commercial losses. Illegal connections, inaccurate meters and billing errors.

Authorised unbilled consumption. Water used legally without charge, eg. firefighting or certain public services.



NRW is not only about wasting treated water. It also wastes energy, chemicals, and staff time.

Imagine how much all these losses cost us in ringgit.

2025 NRW is **5.57 billion liter per day**

THE THREATS ON WATER CYCLE

Urban, industrial and digital growth compete for capacity.

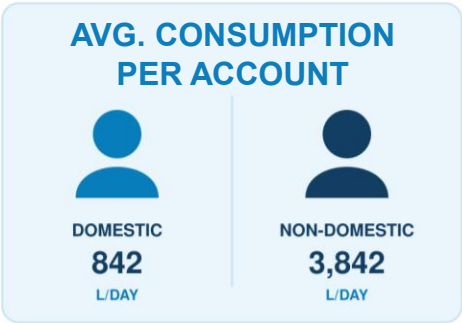
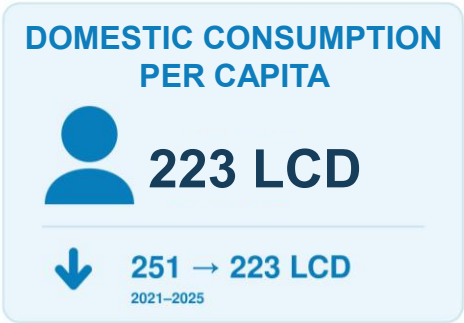
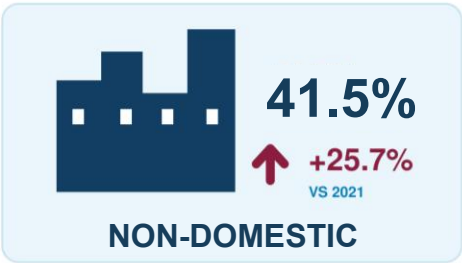
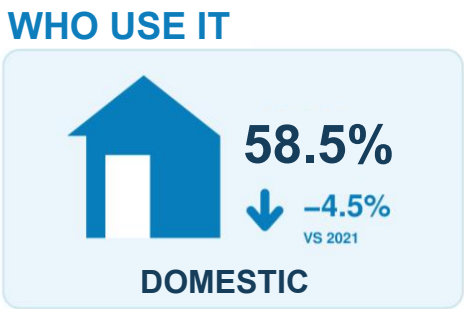
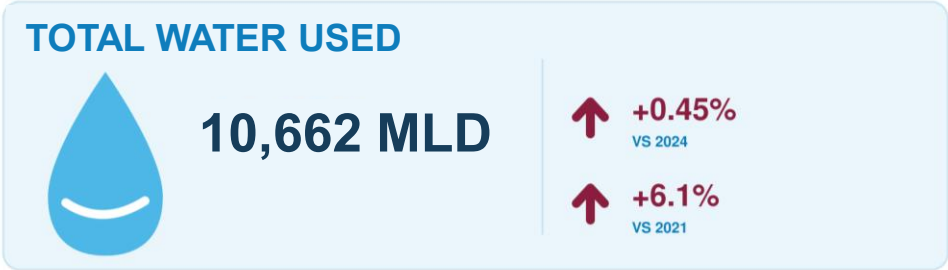
04



Demand

WHO USES OUR TREATED WATER

Homes, businesses, industry and data centres compete for the available supply



STATUS OF DATA CENTRE, 2025	NUMBER
Operational nationally	18 facilities
Operational in Johor	17 facilities
Under construction in Johor	11 projects
Approved in Johor	23 projects
Total Johor project portfolio	51 projects



OUR SAFETY BUFFER - RESERVE MARGIN IN 2025

Reserve margin is the **spare treated-water capacity** left after meeting normal daily demand. It helps during breakdowns, pollution incidents and unusually high demand.

14.4%

NATIONAL RESERVE MARGIN

0 – 32.2%

RANGE ACROSS STATES

15%

SPAN REFERENCE LEVEL

ONLY **SIX STATES** REACHED THE 15%
REFERENCE LEVEL

Average national Reserve
Margin has **declined** from **16.9%**
in **2021** to **14.4%** in **2025**

THE THREATS ON WATER CYCLE

Environmentally harmful behaviour can pollute rivers and increase water use, energy and wastewater volumes.

05



HUMAN BEHAVIOUR ADDS PRESSURE

Water is wasted at the tap, while poor disposal practices pollute rivers before treatment begins.

WASTING WATER AT HOME & WORKS

223 LCD Average domestic consumption in Malaysia, 2025

- › Taps left running during washing.
- › Leaks left unrepaired.
- › Excessive use for cleaning and outdoor activities.

RESULTS. More water must be abstracted, treated, and pumped. More wastewater must be treated and disposed.

POLLUTING THE RIVER WE DEPEND ON

DRAINS CARRY WASTE INTO RIVERS

- › Rubbish, oil and chemicals dumped into drains
- › Illegal discharge by businesses and industries
- › Poor waste handling

RESULTS. More polluted raw water, harder treatment, plant shutdowns and supply disruptions.

ONE PROBLEM RAISES DEMAND. THE OTHER DETERIORATE THE WATER SOURCE.

THE THREATS ON WATER CYCLE

International crisis can drive up energy, chemical and equipment costs

06



**Geo-
politics**

HOW GLOBAL CRISES AFFECT OUR WATER SYSTEM

Events far from Malaysia can still raise costs and delay repairs in our water system.

WHAT HAPPENS GLOBALLY

War, conflict & sanctions

Energy and raw-material prices become less predictable

Shipping delays

Longer routes increase freight costs and delay deliveries

Trade problems & a weaker currency

Imported supplies cost more and become harder to plan



WHAT BECOMES MORE EXPENSIVE

ENERGY

Electricity and fuel used to treat and pump water

CHEMICALS

Chemicals used to clean and disinfect water

EQUIPMENT

Pumps, filters, meters, controls and spare parts

FINANCING

Construction, loans and contract costs



WHAT MALAYSIA MAY FACE

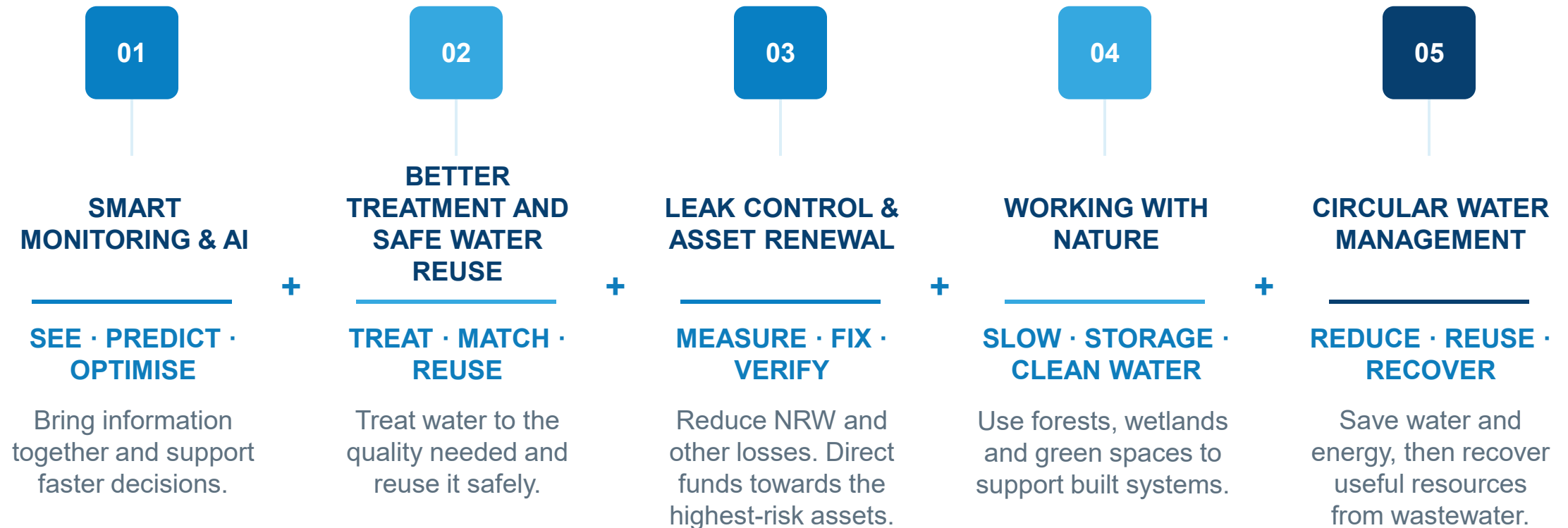
- **HIGHER OPERATING COSTS**
Water becomes more expensive to treat and pump
- **LONGER REPAIRS**
Important parts may arrive late
- **DELAYED UPGRADES**
Treatment plants, pipes and leak-reduction work may be delayed
- **PRESSURE ON WATER SERVICES**
More pressure on prices, public funding and reliability

Changing climate
River pollution
Old infrastructures
Rising demand
Human behaviour
Global crisis

These problems are
connected. How can
technology help
Malaysia keep water
safe and reliable?

TECHNOLOGIES & APPROACHES THAT CAN HELP

Technology should solve real problems across the whole water cycle



THE FULL WATER CYCLE MUST WORK TOGETHER

Good technology connects river protection, treatment, pipes, customers, water reuse and wastewater recovery.

SMART MONITORING, CONNECTED DATA AND AI

Technology helps only when people receive clear alerts and know what to do next.

SEE THE SYSTEM EARLIER

SENSORS AND EARLY WARNING

5+

River-quality indicators

Turbidity · conductivity · pH · ammonia · dissolved oxygen

24/7

Smart meters

Flag unusual household or business consumption

2

Pressure and flow sensors

Reveal a developing burst or unusual network condition

2

Catchment-viewing tools

Satellites and drones support surveillance and inspection

TURN INFORMATION INTO ACTION

CONNECTED WATER INFORMATION

INFORMATION BROUGHT TOGETHER

GIS

Meters

Plant systems

Maintenance

Complaints

Weather

AI CAN SUPPORT FOUR PRACTICAL TASKS

- Predict water demand
- Predict which pipes may fail
- Reduce energy use
- Spot unusual events

THE PRACTICAL TEST: WHAT HAPPENS AT 2:00 AM?

DETECT

Sensor spots a problem



VERIFY

Check that the warning is real



ALERT

Warn the correct team quickly



RESPOND

Follow an agreed response plan

WHAT MUST BE IN PLACE

Accurate
sensors

• Reliable communications •

Consistent asset
records

• Cybersecurity •

Trained staff

USE THE RIGHT TREATMENT FOR THE RIGHT JOB

Treatment should match what is in the source water and how the final water will be used.

TREATMENT SELECTION

SOURCE QUALITY

What contaminants are present?



CHOOSE THE MOST PRACTICAL PROCESS

Required quality, energy use, maintenance and waste produced



INTENDED USE

How clean does the water need to be?

TREATMENT OPTIONS

Membranes

Adsorption

Powerful oxidation

High-performance filter

Advanced biological treatment

SAFE DRINKING WATER

Drinking

Food preparation

Personal hygiene

Keep the highest-quality water for drinking, cooking and personal use.

SAFELY TREATED RECLAIMED WATER

Cooling

Irrigation

Construction

Selected industry

Using reclaimed water for suitable jobs to protect drinking-water supplies.

THE MOST ADVANCED OPTION IS NOT AUTOMATICALLY THE MOST SUITABLE PROCESS

LEAKAGE CONTROL & RISK-BASED ASSET RENEWAL

Technology delivers lasting NRW reduction only when it is embedded in a repeated management cycle.

TOOLS TO FIND, CONTROL AND PREDICT LOSSES

District-metered areas

Pressure-management valves

Acoustic loggers

Tools that pin-point leaks

Smart customer meters

Predictive asset models

THE NRW MANAGEMENT CYCLE

01 MEASURE



02 FIND THE CAUSE



03 INTERVENE



04 VERIFY THE SAVING



05 CONTINUOUS MONITORING

RISK-BASED ASSET REPLACEMENT

- Material & age
- Failure history
- Pressure
- Soil
- Traffic loading
- Water chemistry
- Repair frequency
- Failure consequence

REPLACE THE HIGHEST-RISK ASSETS, NOT SIMPLY THE OLDEST PIPES

USE NATURE TO HELP MANAGE WATER

Use land and ecosystems as part of the water-management system.

LANDSCAPE INTERVENTIONS

01

Protected forests

Protect headwaters and reduce erosion

02

Wetlands

Hold water and filter pollutants

03

River buffers

Trap sediment and pollution before they enter rivers

04

Detention areas

Temporarily hold heavy rain

05

Permeable surfaces

Allow rainwater to soak into the ground

06

Urban rain gardens

Capture and treat local rainwater runoff

SYSTEM BENEFITS

- **SLOW RUNOFF**
Reduce the speed and amount of runoff
- **CLEANER WATER**
Reduce sediment and pollution entering rivers
- **MORE RECHARGE**
Help refill groundwater
- **LOWER FLOOD PEAKS**
Reduce pressure on drainage systems during heavy rain

NATURE SUPPORTS BUILT INFRASTRUCTURE. IT DOES NOT REPLACE IT.

Nature-based measures complement treatment plants and drainage infrastructure while adding ecological and social value.

CIRCULAR WATER MANAGEMENT

A circular system uses less water, reuses suitable water and recovers energy or materials.

CONVENTIONAL: ONE-WAY FLOW

ABSTRACT → TREAT → USE → DISCHARGE

CIRCULAR: KEEP WATER & RESOURCES IN USE

USE LESS → REUSE WATER → RECOVER VALUE → SAFE DISCHARGE

WHAT WE CAN RECOVER

- | | | |
|----|------------------------|--|
| 01 | RECLAIMED WATER | Treated wastewater further for suitable industrial use |
| 02 | BIOGAS | Microbes convert sludge into renewable energy |
| 03 | BIOSOLIDS | Treated solids can be reused when safety standards are met |

MOVE FROM ONE-OFF PROJECTS TO A PLANNED MARKET

START WHERE REUSE MAKES FINANCIAL SENSE

- Start with large users close to sewage treatment plants.
- Choose based on the total cost over the project's life, not only the purchase price.

WAYS TO REDUCE ENERGY COSTS & EMISSIONS

Efficient aeration • Variable-speed drives • Optimised pumping • Solar generation • Energy recovery • Biogas

WHAT WE SHOULD DO NEXT

Priorities 1 - 3: Plan ahead, protect water sources and stop losing treated water

01

PLAN BEYOND THE NEXT CRISIS

NORMAL · DRY · EMERGENCY

- Match future development with available water.
- Consider climate change in planning.
- Put water as top priority in planning.

+

02

PROTECT WATER SOURCES FIRST

PLAN · MONITOR · PREVENT

- Protect rivers as ecosystems and drinking-water sources.
- Adopt wholistic approach through IRBM.
- Invest on alternative water sources.

+

03

STOP LOSING TREATED WATER

MEASURE · VERIFY · SUSTAIN

- Invest in digital solutions.
- Count NRW savings as new supply capacity.
- Renew assets according to risk.

WHAT WE SHOULD DO NEXT

Priorities 4 - 6: Diversify supply, involve the public, and scale innovation

04

BUILD RECLAIMED-WATER MARKETS

EFFICIENCY · ALTERNATIVES
· DROUGHT

- Prioritise large non-potable users near sewage treatment plants.
- Keep drinking water for uses that require drinking-water quality.

+

05

MAKE THE PUBLIC PART OF WATER SECURITY

INFORM · EDUCATE ·
PARTICIPATE

- Provide timely information on water use, leaks, disruptions and pollution.
- Strengthen water-saving practices and early education.

+

06

CREATE AN INNOVATION PATHWAY

INITIATE · PILOT · VALIDATE ·
PROCURE

- Fund priority problem based on industry driven needs.
- Help proven Malaysian solutions find first buyer.

A WATER-SECURE COUNTRY ACTS BEFORE THE WARNING LIGHTS TURN RED

Plan early · protect sources · use water efficiently · diversify supply · scale innovation · involve everyone

TAKE-HOME QUIZ

1. Should major new developments be required to publish a long-term water balance and drought operating plan? (5 marks)
2. Can NRW reduction be evaluated and financed in the same way as additional treatment capacity? (5 marks)
3. Which non-potable demands in Johor could be supplied reliably with reclaimed water within the next five years? (5 marks)
4. What changes are needed for Malaysian water technologies to move from research lab to utility procurement? (5 marks)
5. What need to be done to speed-up the institutionalization of Integrated River Basin Management (IRBM)? (5 marks)

MALAYSIA'S WATER FUTURE DEPENDS ON HOW EARLY WE ACT.

Connect the whole water cycle.

Act before the warning signs
become critical.

THANK YOU

Water security is a shared responsibility.

We are not the only ones who depend on water.

Our Commitments.

Protect EVERY SOURCE.

Count EVERY LITRE.

Choose technology for REAL NEEDS.

Adopt SUSTAINABLE water systems