

# Training Workshop on Integrated Flood Management

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## Flood Impact on Water Supply & Sanitation



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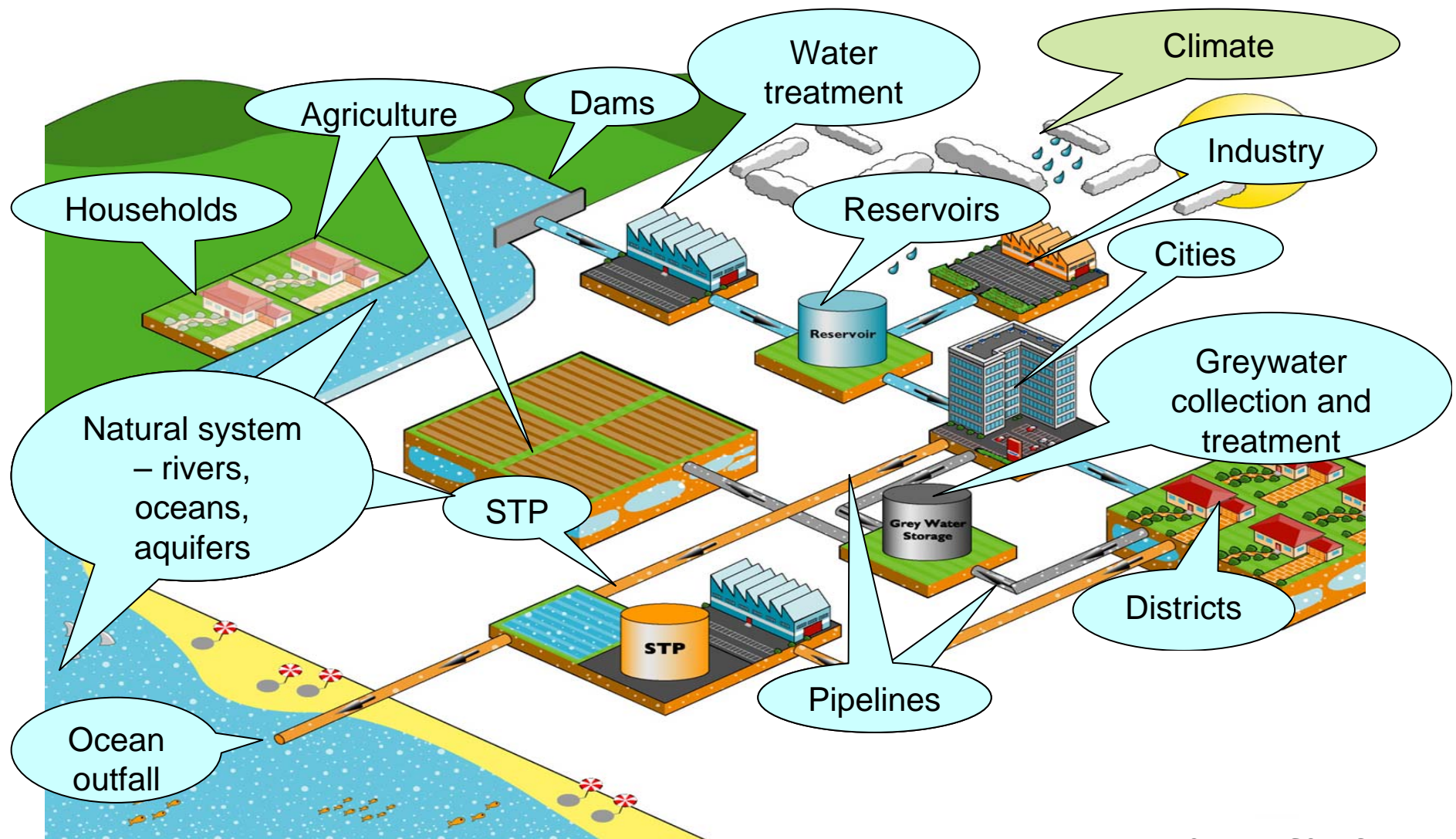
- **Introduction**
- **Flood impact & protection of WWT facilities**
- **Safeguarding supply during extremes**
- **Flood waters as a resource**



# Introduction



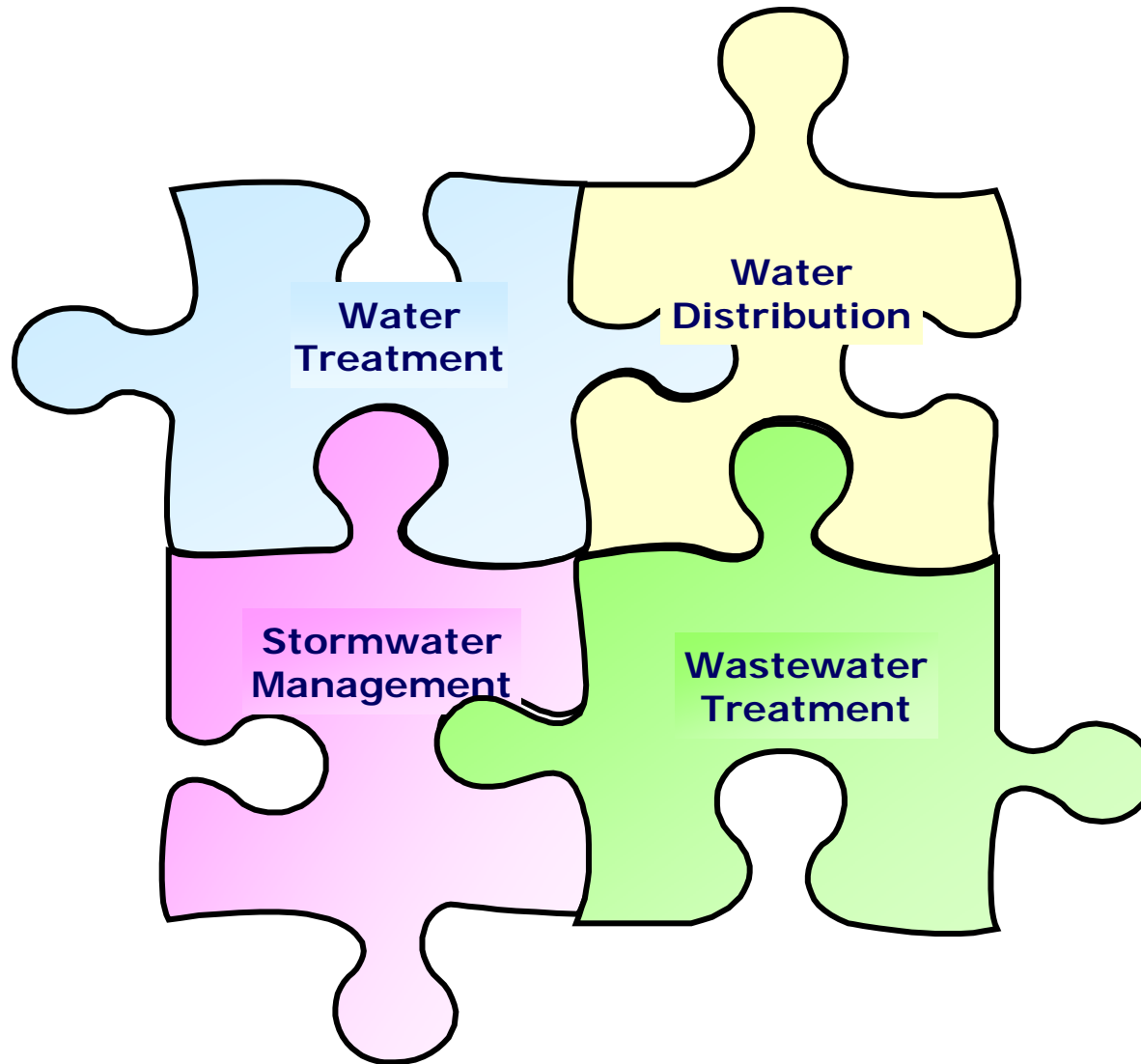
# Urban Water Cycle



Source: CSIRO



# Components of Water Supply & Sanitation





# Risk Management for Water & Wastewater





# Definitions of Water Supply Conditions

- 1) Regular conditions:  
Water supply within legal and other adopted criteria
- 2) Irregular Conditions:
  - **Hazard:**  
Incident or accident causing an interrupted water supply for a limited number of customers and period
  - **Calamity:**  
Serious interruption of water supply during a longer period and larger scale
  - **Disaster:**  
Extreme serious interruption of water supply being part of serious problems



# **Flood Impact & Protection of WWT**



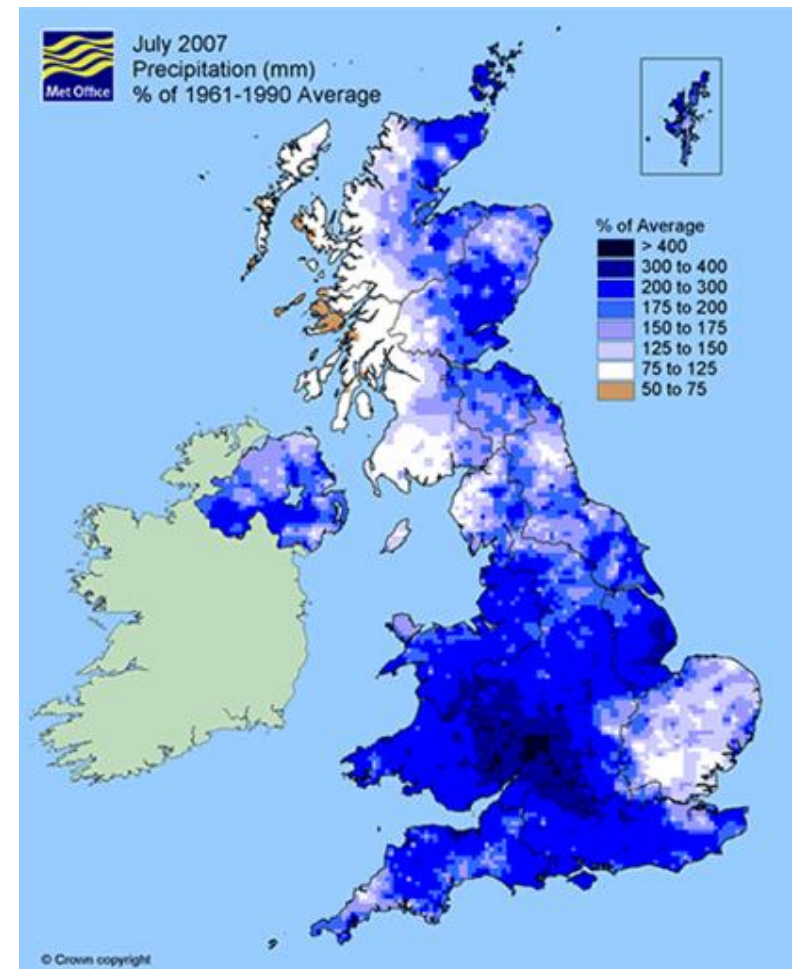


# Flood Impact on Water Supply & Sanitation

(Gloucestershire, UK, 2007)

- **1 in 150 yr flood > 1 in 100 yr design flood**
- **> 300 sewage treatment works flooded**
- **6 water treatments works shutdown**
  
- **Mythe WTW (Gloucestershire)**
  - WTW shutdown due to site flooding
  - No piped water supply to 340,000 consumers
  - Full recovery of supply system took **16** days
  - Alternative supplies provided by tankers, temporary tanks & bottled water

J. Foster 2007





# Flood protection of Water & Wastewater Facilities

- 1) **Design** of locations of WWT at elevations **higher** than flood risk level
- 2) *Structural measures (e.g. **flood walls and levees**) for flood protection*
- 3) **Prevention of Back Flow** in water & wastewater facilities (e.g. flap valves)

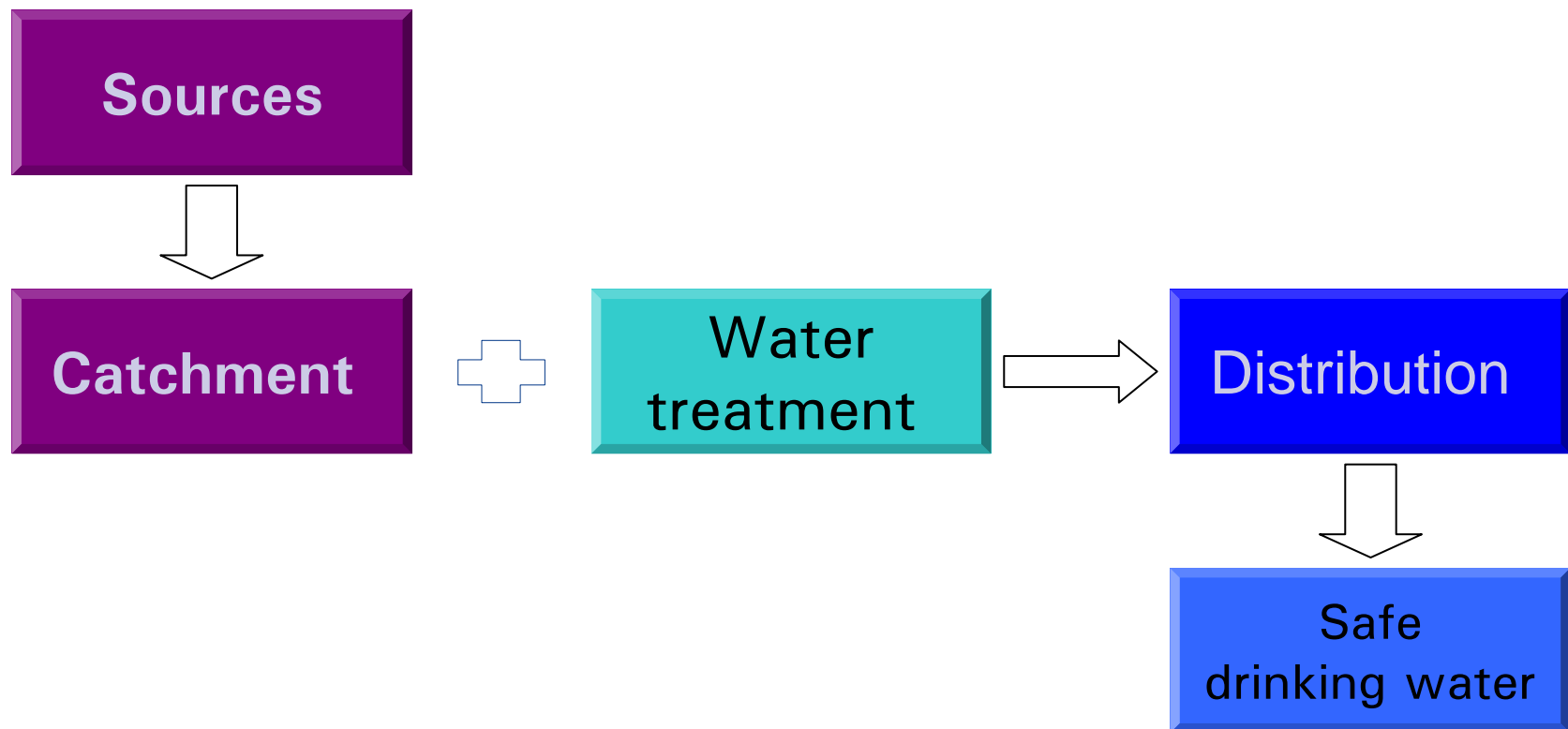




# **Safeguarding Water Supply**



## Main elements of a water supply system





## Examples of pipe bursts



Water Companies & KIWA



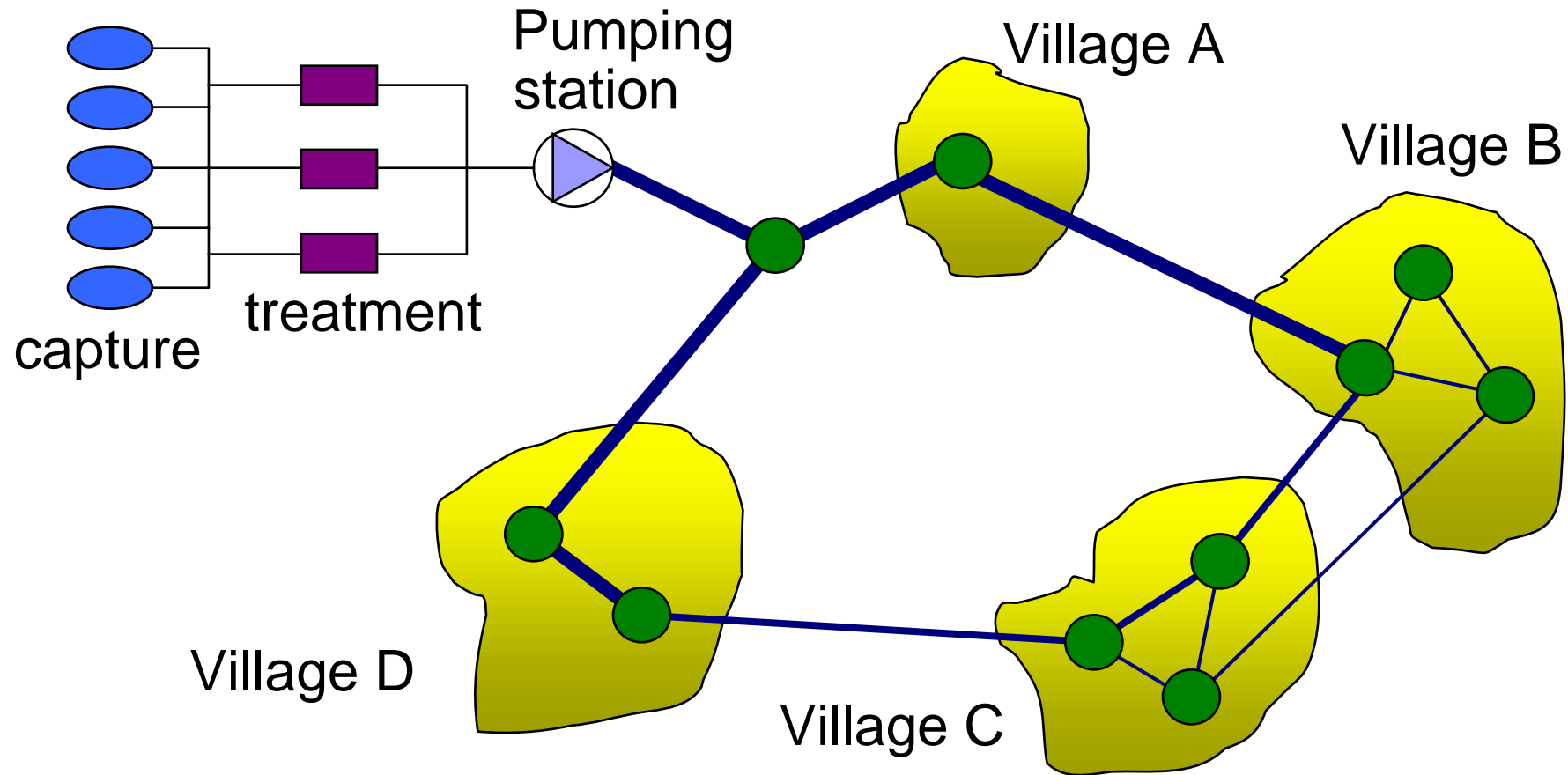
## Consequence of a pipe failure: Induced flood



Water Companies & KIWA

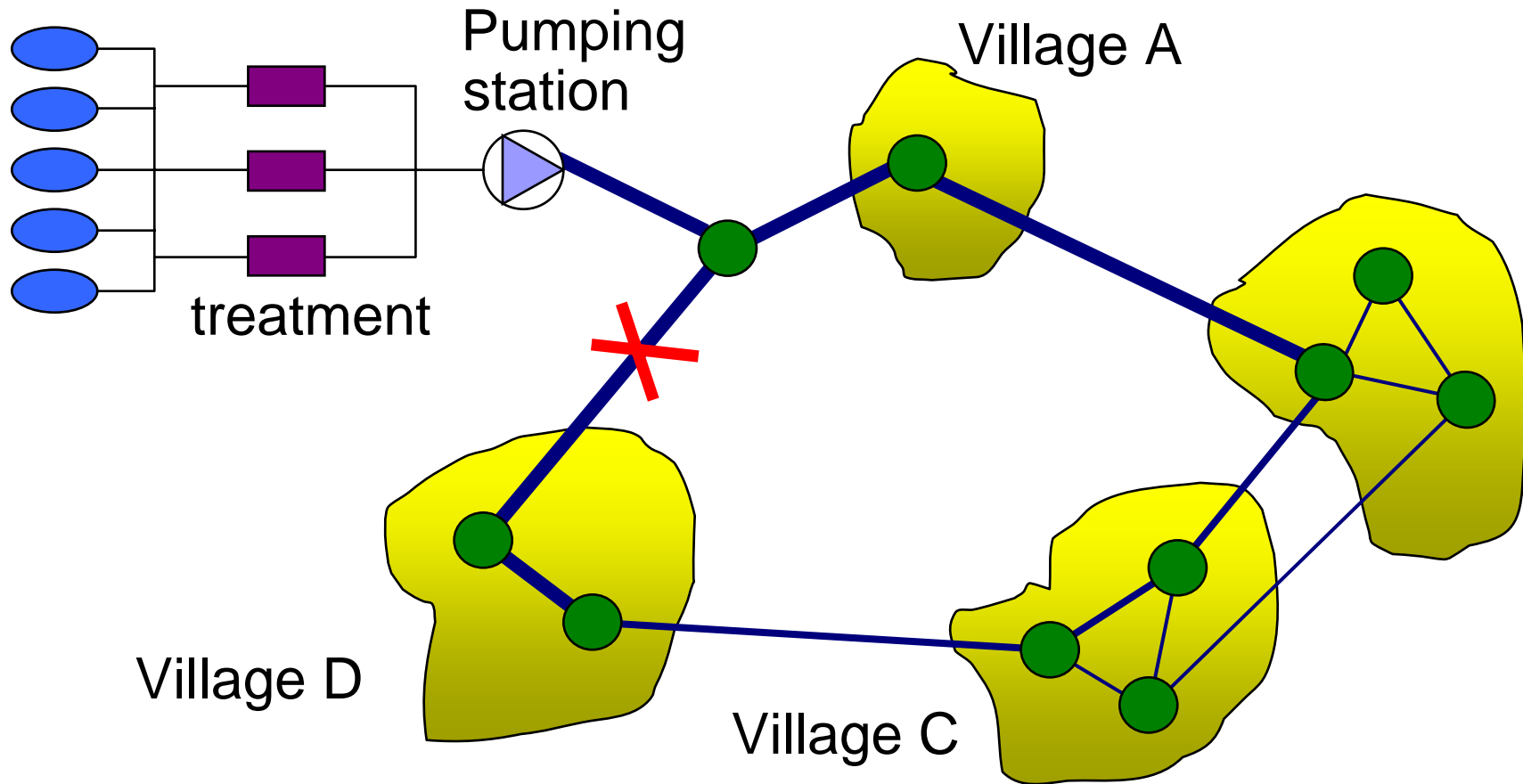


## Scheme of a water drinking system





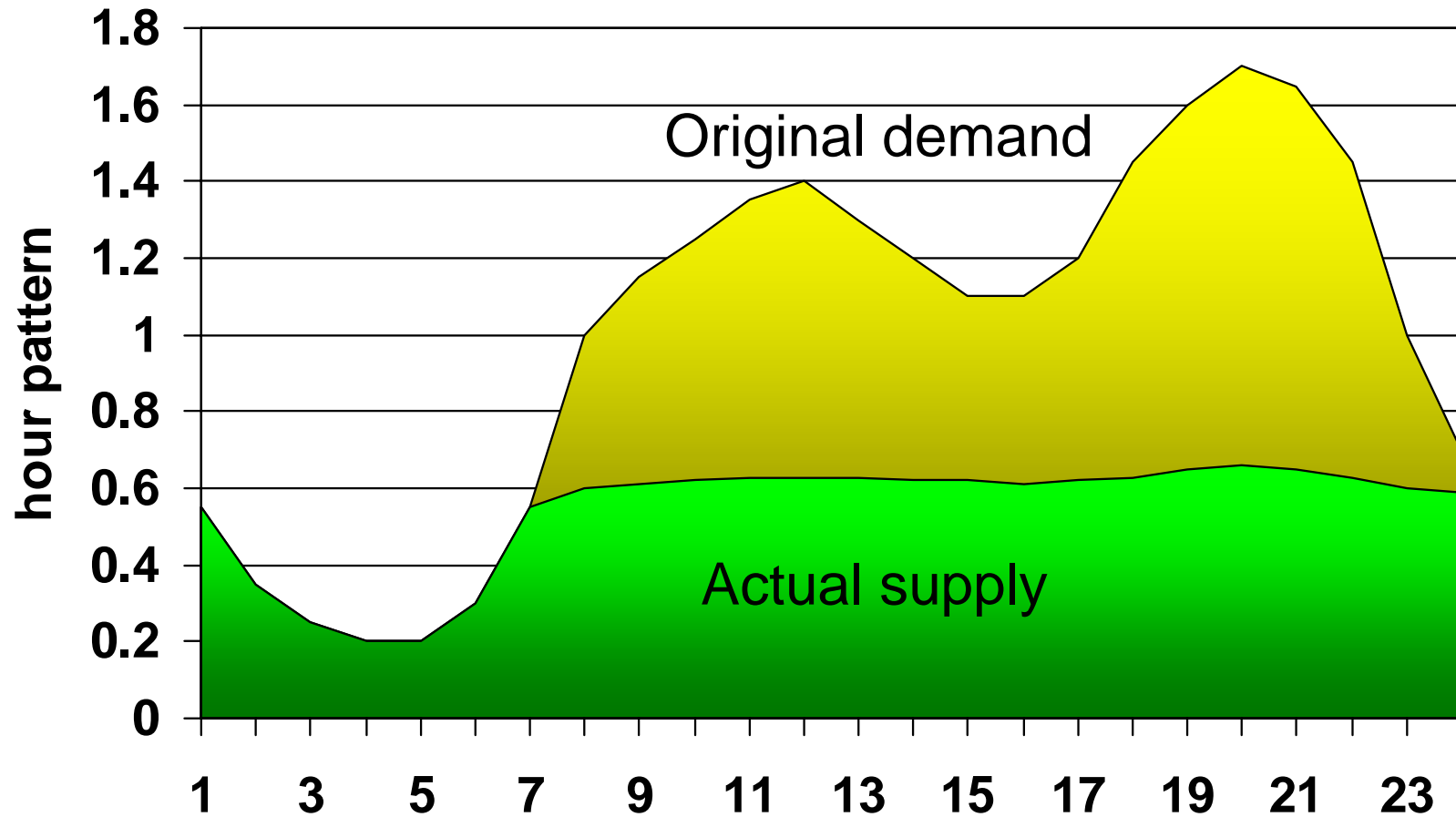
## Systematic analysis of failure: (a pipe burst)





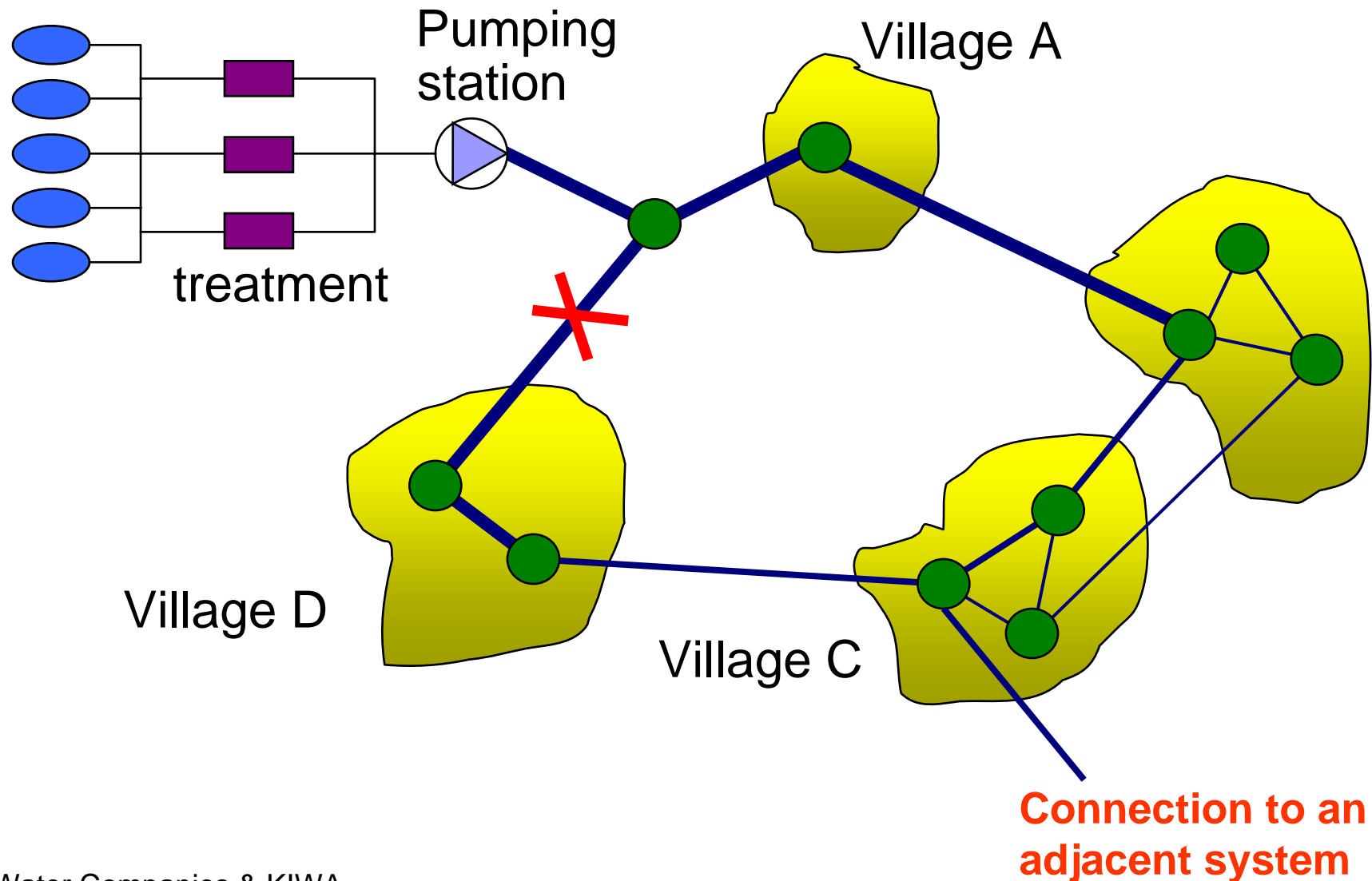


## Supply & Demand in Village D: (a pipe burst)



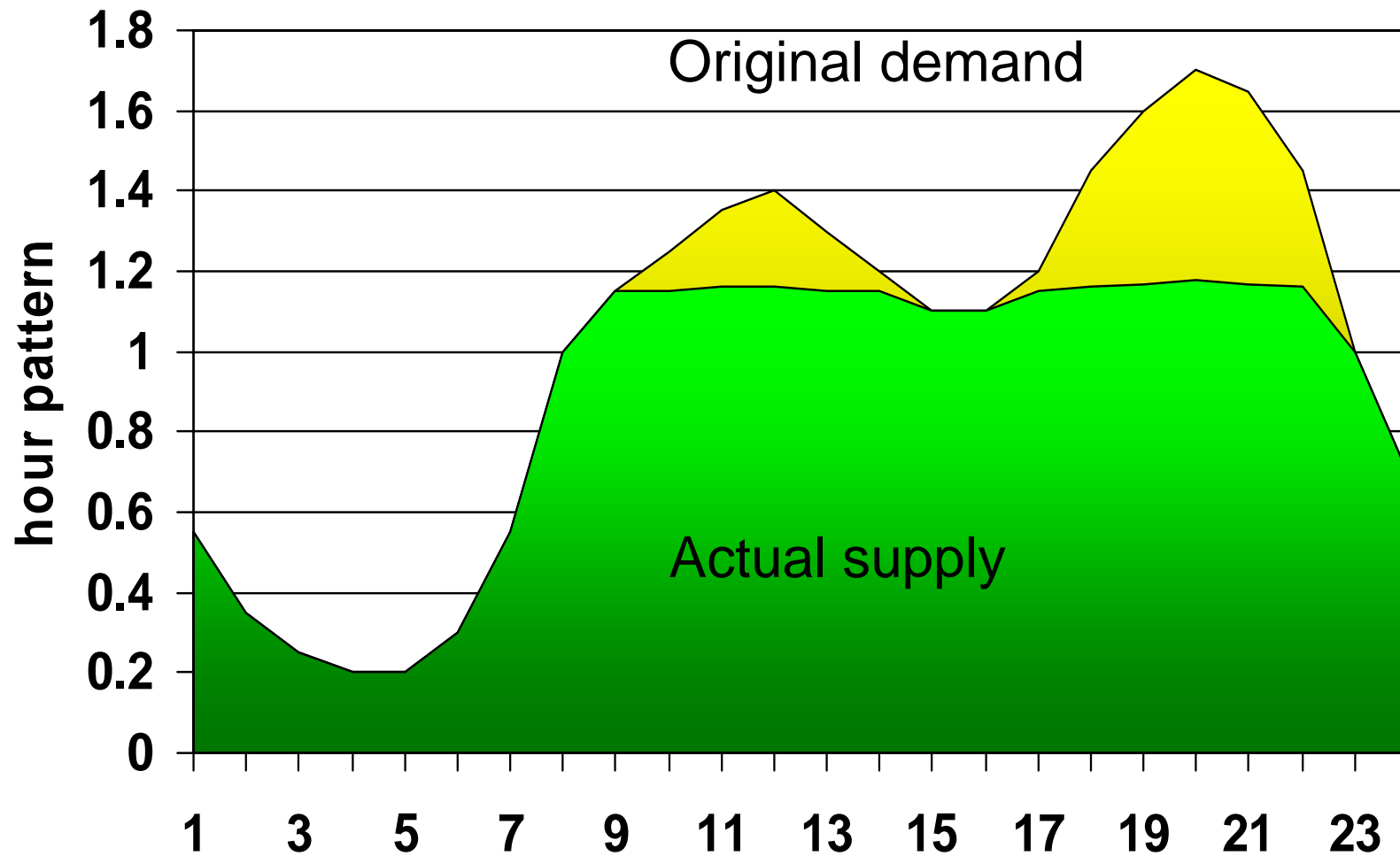


## Systematic analysis of failure: **A solution**



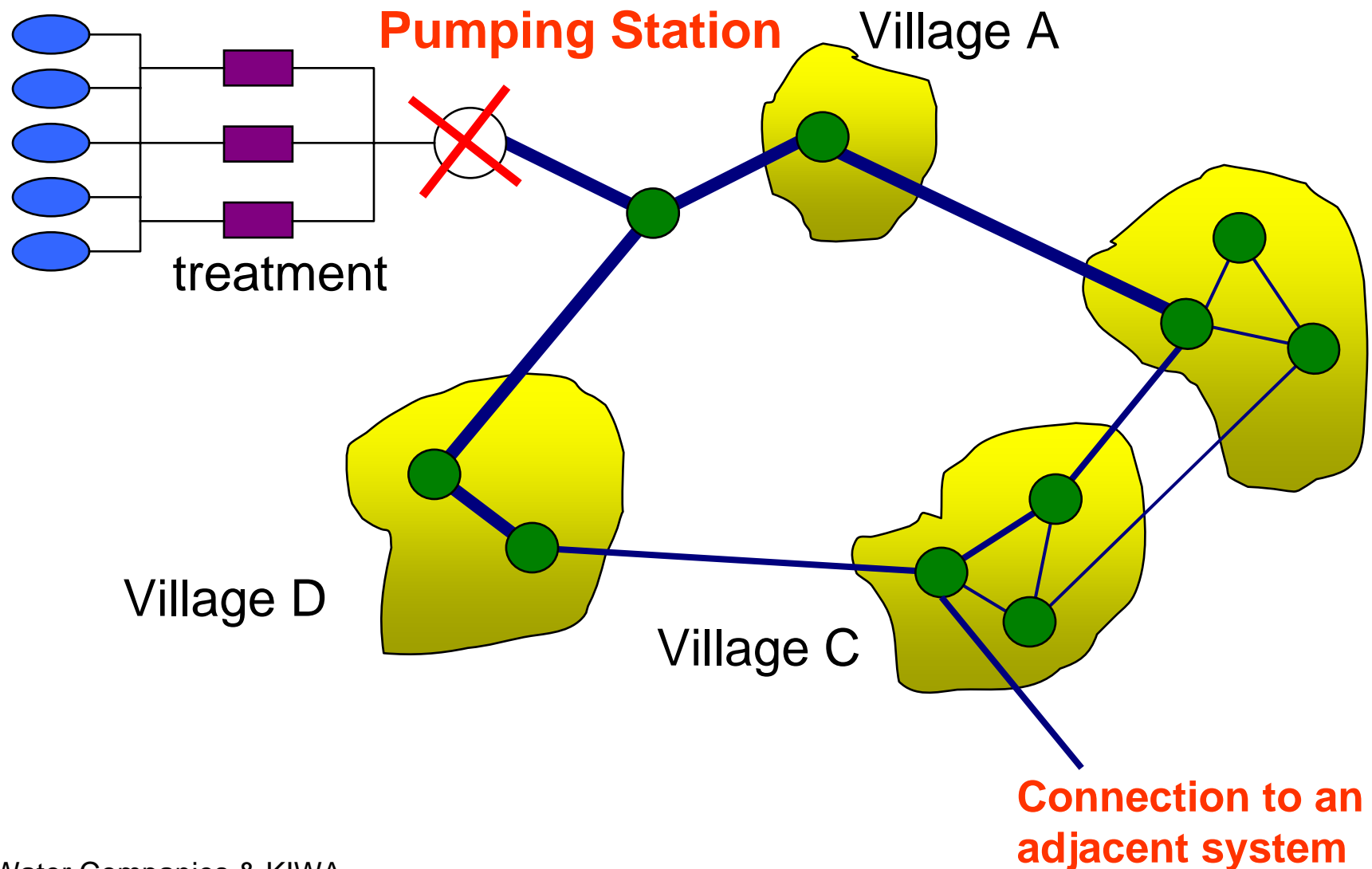


## Supply & Demand in Village D: (after the solution)





## Failure of a station: Less risk in new situation



## Facilities for Emergency Water Supply & Sanitation



**Emergency Latrine** Superstructure Development



Constriction of a **water tank** in Sri Lanka

Source: Oxfam

# **Filtration System for Emergency Water Supply**

## **Response to Flood in Pakistan**



**Comparison of water samples before and after undergoing treatment with the filters**

Photo by : Gui Wai Khan/CRS Pakistan



**Relief kits provided to families in villages  
Trainings by World Health Organization**

**Source: Christian Relief Society**



## Emergency water supply: Bottled Water





## Emergency water supply: Large Reservoirs



Water Companies & KIWA





# Emergency water supply: Flexible Reservoirs



Water Companies & KIWA

# Flexible water tank carried by an army truck



Water Companies & KIWA



# Flexible water tank carried by an army truck



Water Companies & KIWA



## Emergency reservoir & small network :(a test)



Water Companies & KIWA



## Emergency tap points :(a test)



Water Companies & KIWA



## Lessons learnt (KIWA, Netherlands)

- **Use of network models for scenarios of emergency situations**
  - Inter-connection of water systems: enhances reliability though expensive.
- **Need for tests of emergency protocols in practice**
  - Good logistics
  - Good access to water distribution points
  - Adequate crisis communication
  - Clear specification of roles & responsibilities of each party
- **Preparedness for emergency situations**
  - Agreement with suppliers for sufficient instant capacity of bottled water
  - Equipment being kept clean & ready to use
  - Need for many care takers at the distribution points



# **Flood Waters as a Resource**



# Flood waters as a resource : Chinese Experience

Study by office of State Flood Control Headquarters of China

## Can Flood Waters be Used as a Resource?

- 1) With general attribute of water resource : YES
- 2) Not available in long term : NO
- 3) More risks than regular water resource
- 4) Use of *flood water as a resource*

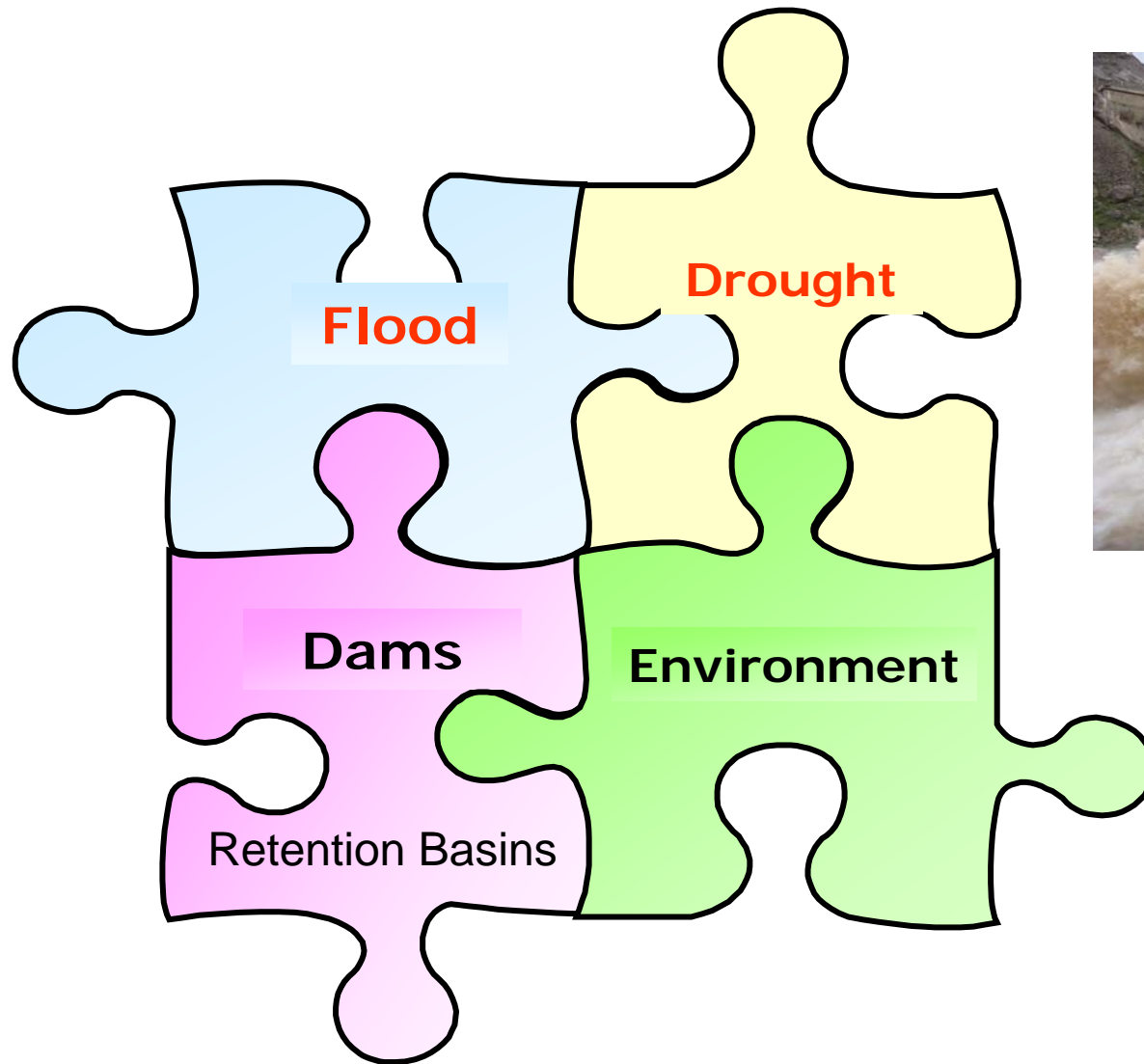
more accurate than *flood water utilization*

~~“Drain away floodwater into the sea”?~~





## Flood waters as a resource: Inter-relationships





# **Flood waters as a resource: Practice Summary**

Study by office of State Flood Control Headquarters of China

- 1) **Make use of flood water in flood seasons**
- 2) **Divert water from main stream during flood seasons**
- 3) **Trans-basin allocation of flood water resource**
- 4) **Strengthen management and dispatch detained flood water for dry year**
- 5) **Conduct flood diversion through utilization of detention basins**

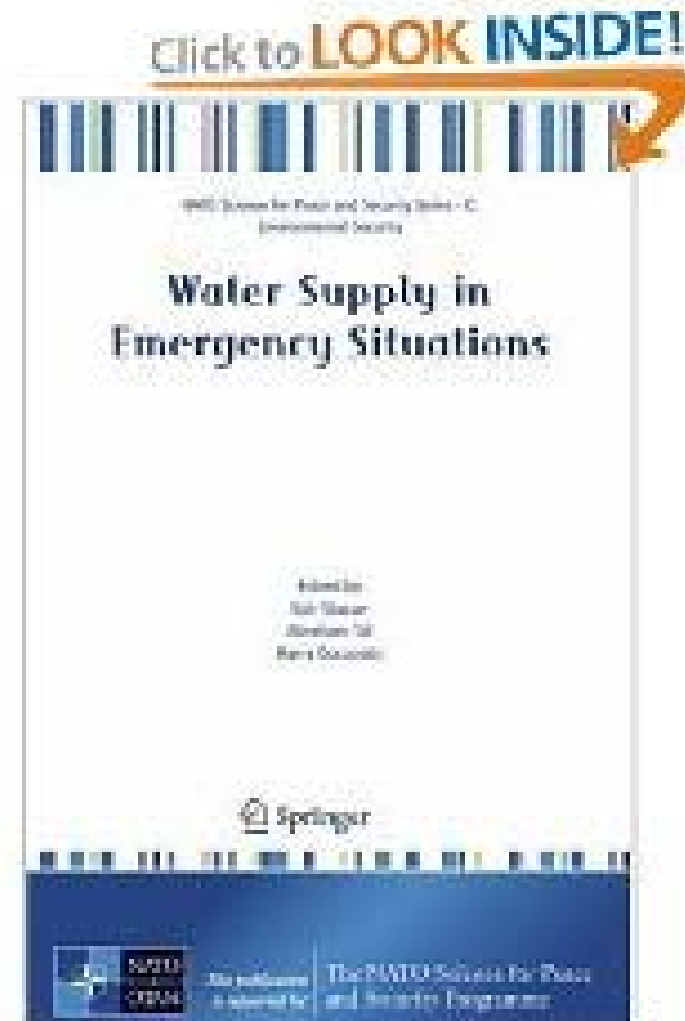
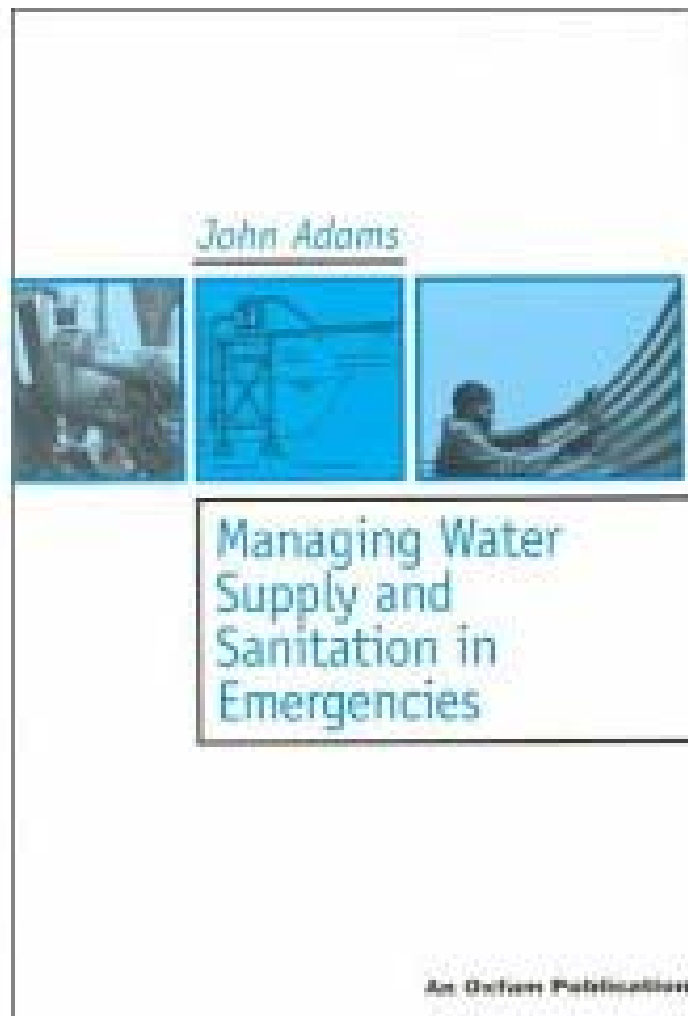


# **Flood waters as a resource: Recommendations**

Study by office of State Flood Control Headquarters of China

- 1) **Keep the principles** (realistic, scientific, economical, ...)
- 2) **Observe objectives** (water supply, sea outflow, water use, ...)
- 3) **Promote** use for flood control, droughts, developments, ...
- 4) **Identify suitable regions** for implementation
- 5) **Select** qualified basins, regions & entities as **pilots**

## Some Books for Further Reading





## References:

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## Further Reading:

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**Thank you for your attention**

