4th IWA International Symposium on Water and Wastewater Technologies in Ancient Civilizations

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Water and sanitation: lessons learned from the past to a sustainable future

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| OUTLINE

WATER AND SANITATION: FROM ANTIQUITY TO THE XXI CENTURY

- URBAN WATER: DRINKING WATER - THE MAIN CONCERN
- POOR SANITATION SYSTEMS: A THREAT FOR PUBLIC HEALTH

WATER AND SANITATION: TOWARD TO A SUSTAINABLE FUTURE?

- WATER AND SANITATION: CURRENT SITUATION
- DEMOGRAPHY, URBANISATION AND CLIMATE CHANGE
- PUBLIC HEALTH: THE COMPLEX CHALLENGES OF THE CONTEMPORARY WORLD

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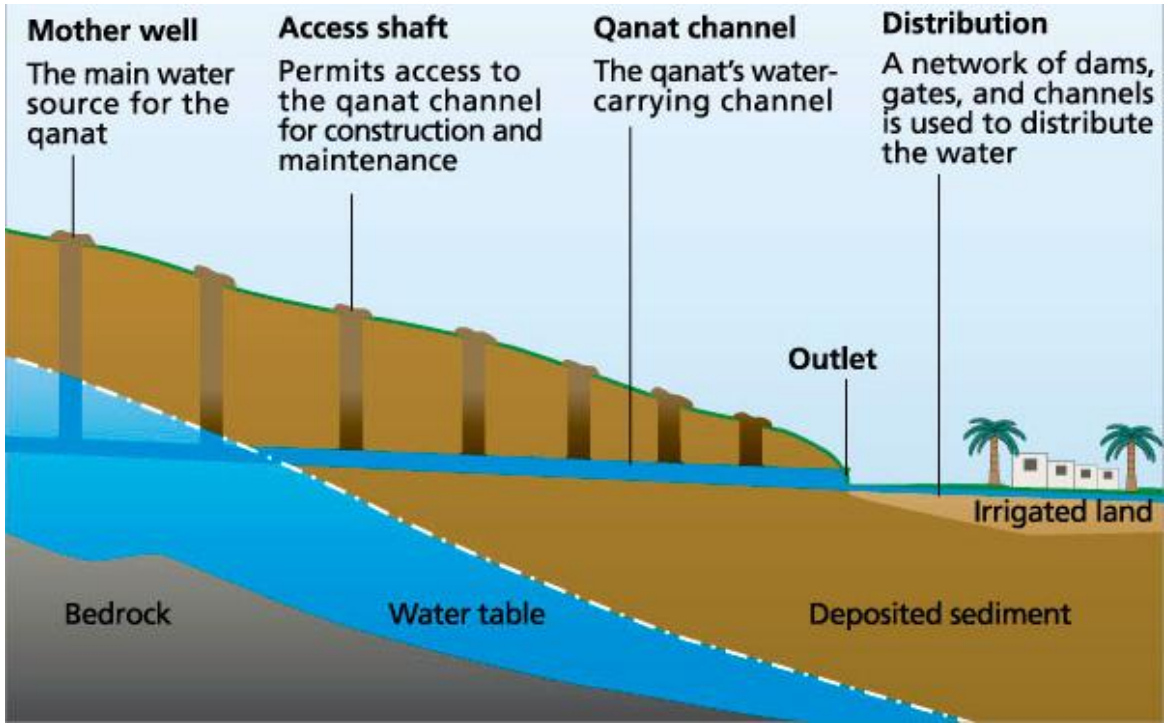
Qanat system (1.000 BC - Persia)



Aqueducts in the Helenistic period (323-146 BC)

- **The Roman water supply system (aqueduct)**

The Roman water supply system (aqueducts in Imperial Rome)

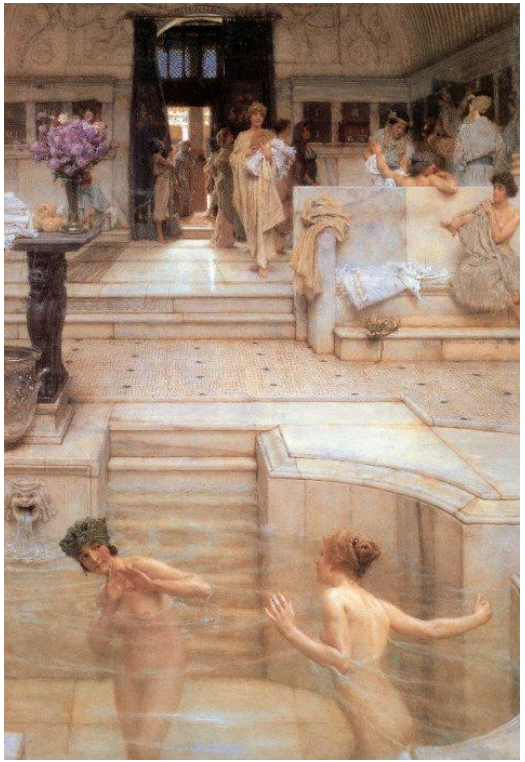
Aqueduct	Construction date	Length (km)	Flow	
			(m^3/d)	(L/s)
Aqua Appia	312 B.C.	17	75.737	876
Anio vetus	270 B.C.	64	182.517	2.111
Aqua Marcia	144 B.C.	91	180.068	2.083
Aqua Tepula	125 B.C.	18	68.516	793
Aqua Iulia	33 B.C.	23	68.516	793
Aqua Virgo	19 B.C.	20	103.916	1.202
Aqua Alsietina	2 B.C.	33	16.257	188
Aqua Claudia	38 A.D.	68	191.190	2.211
Anio Novus	38 A.D.	87	196.627	2.274
Aqua Traiana	109 A.D.	57	118.000	1.367
Aqua Alexandrina	226 A.D.	22	21.632	250
Total		499	1.222.976	14.147

- **The Roman water supply system** (cistern and *castellum divisorium*)

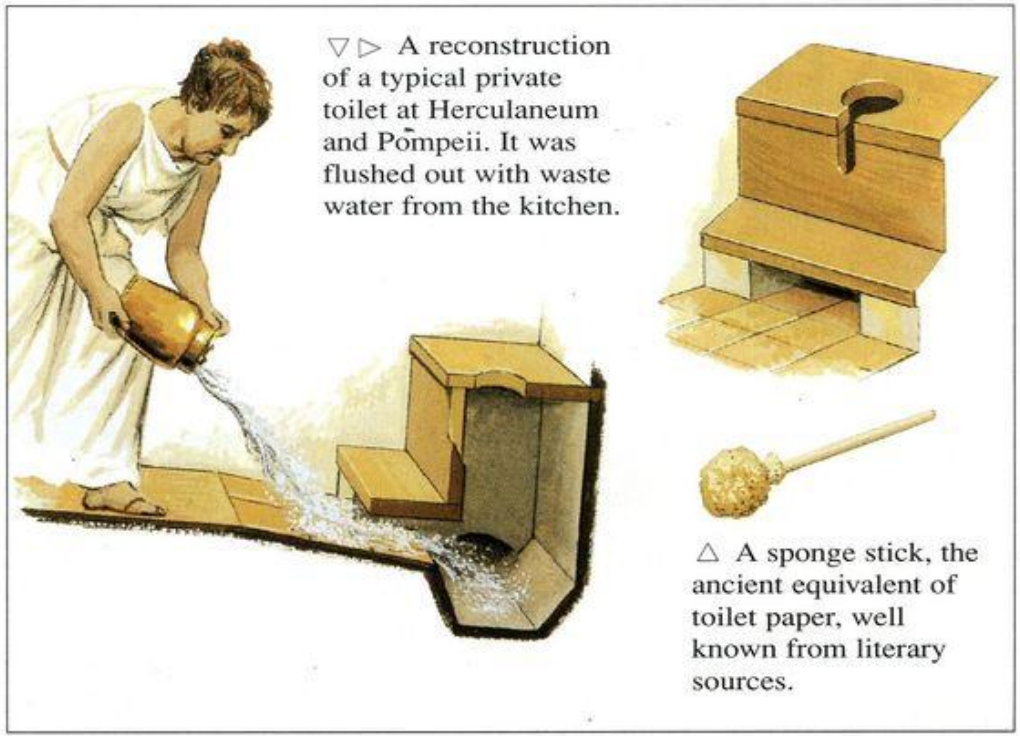
URBAN WATER: DRINKING WATER - THE MAIN CONCERN

- **The Roman water supply system** **(distribution lead pipe)**

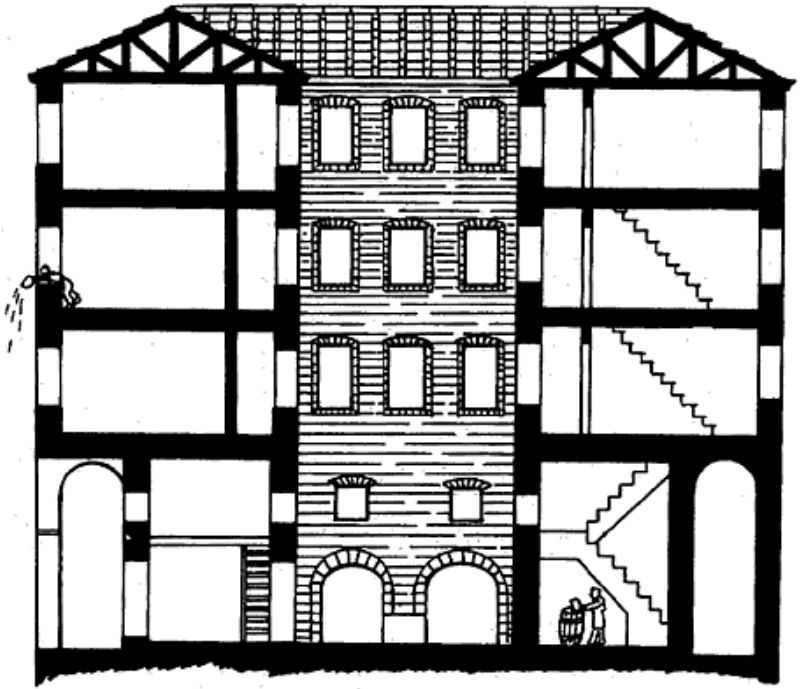
- **The Roman water supply system** **(fountains and public baths)**

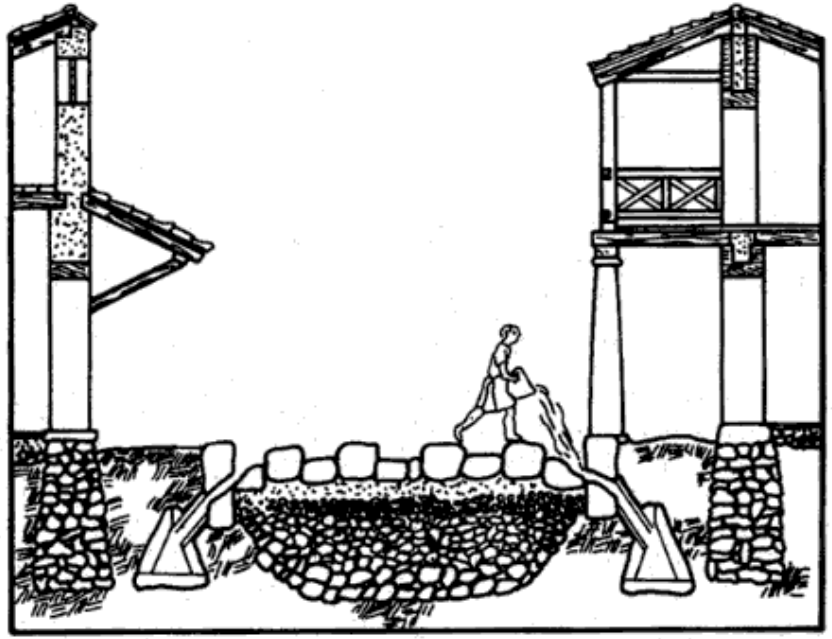


- **The Roman wastewater collection system (domestic toilet)**



- **The Roman wastewater collection system** (domestic sewage discharge)





- **The Roman wastewater collection system (public toilet - latrine)**

| WATER AND SANITATION: FROM ANTIQUITY TO THE XXI CENTURY

URBAN WATER: DRINKING WATER - THE MAIN CONCERN

- **The Roman wastewater collection system** (sewer overflow to river Tiber – cloaca maxima)

- **Middle Ages** (476-1453) **(no drinking water and sanitation for 1000 years)**

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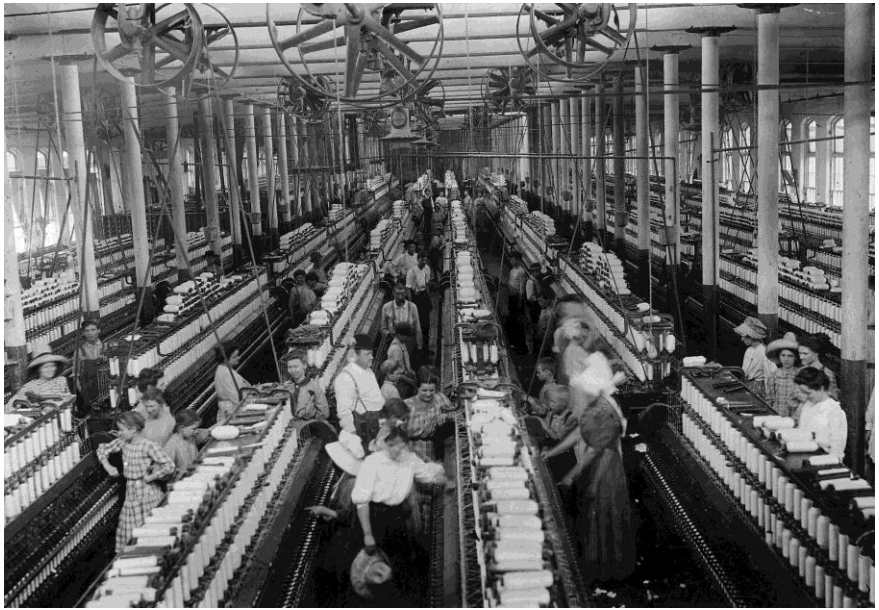
URBAN WATER: DRINKING WATER - THE MAIN CONCERN

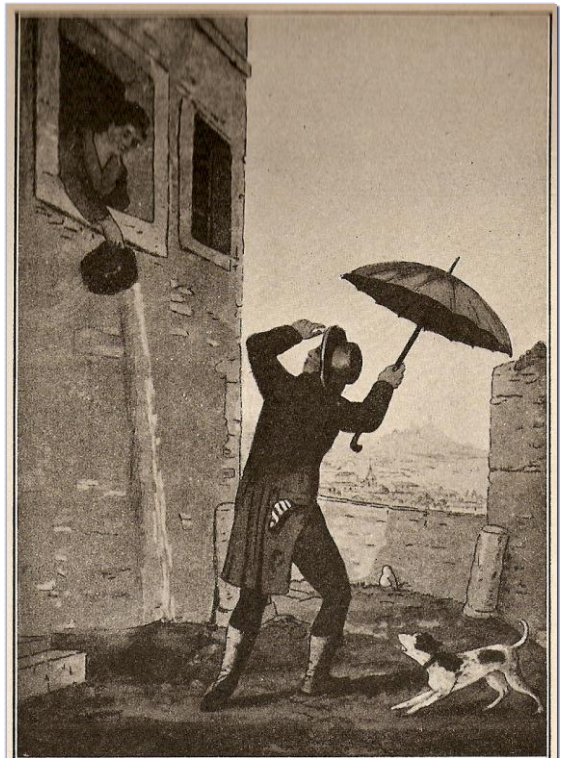
- **Middle Ages** (476-1453) (no drinking water and sanitation for 1000 years)

- **The Renaissance** (XV-XVIII Century) (monumental fountains in Rome)

- **Modern history** (Industrial Revolution XIX Century)



Modern history (XX Century)

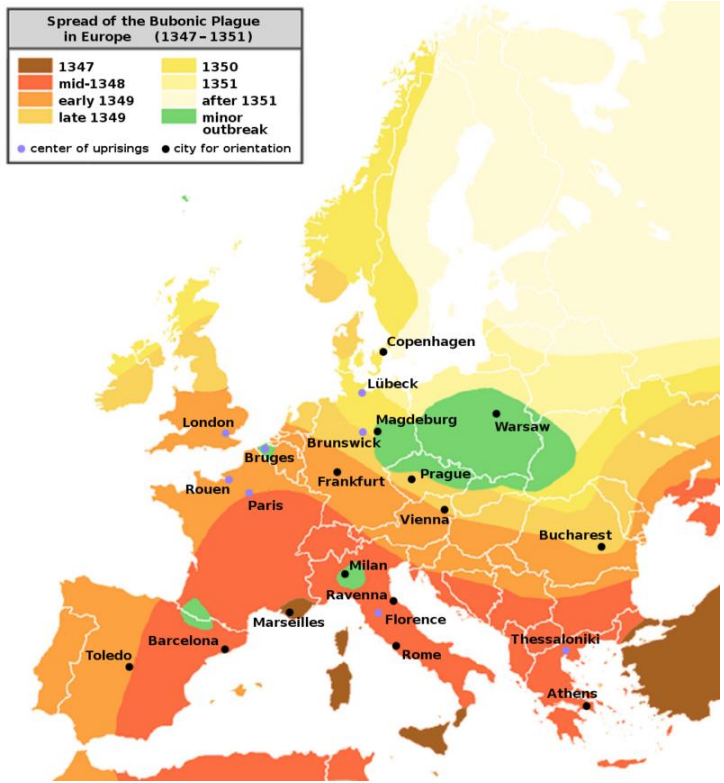


- **Contemporary age** (1945 -) **(personal privacy)**

POOR SANITATION SYSTEMS: A THREAT FOR PUBLIC HEALTH

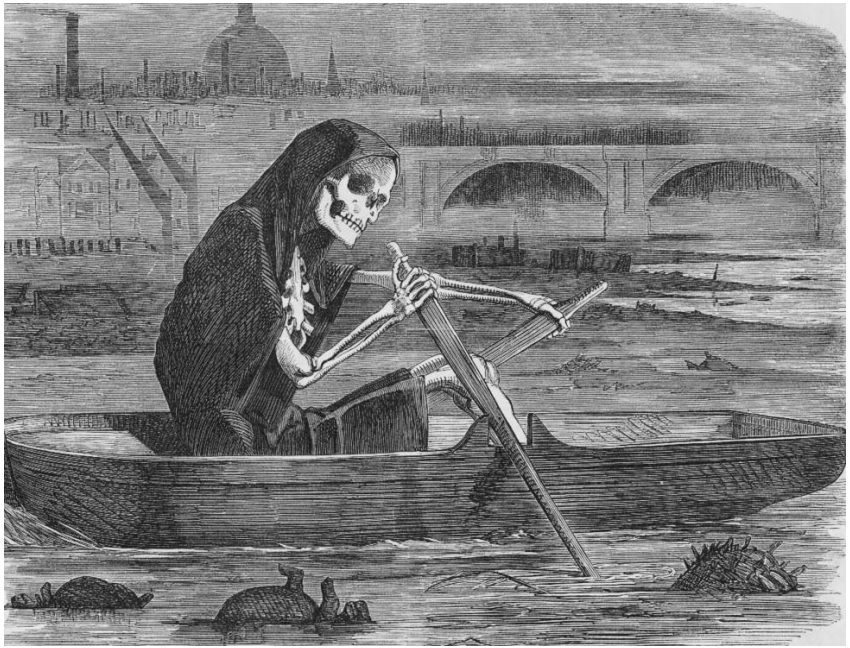
- **Waterborne diseases (pathogenic microorganisms) in Antiquity**
  - 3180 BC: Epidemics in Egypt
  - 1190 BC: Epidemics in Greece
  - 790 BC, 710 BC, 640 BC: Epidemics in Rome
  - 430 BC – 426 BC: Epidemics in Athens (30.000 people dead)
- **Pathogens causing epidemics**
  - Multiple pathogens were the cause of epidemics with **typhoid** being the principal disease associated with sewage contamination of drinking water

Waterborne diseases (pathogenic microorganisms) in Middle Ages



Bubonic plague in Florence, 1348 (illustration of Marcello)

- **Waterborne diseases (pathogenic microorganisms) in XIX century**



Waterborne diseases in XIX century (scientific milestones)

- **John Snow (1854)**

  Showed that water contaminated by sewage was the cause of cholera (took the handle off the Broad Street pump)

- **Louis Pasteur (1863)**

  Studied and identified microorganisms

- **Robert Koch (1884)**

  Isolated a pure culture of *Vibrio cholerae*

POOR SANITATION SYSTEMS: A THREAT FOR PUBLIC HEALTH

- **Learning with History when looking at the future**

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WATER AND SANITATION: CURRENT SITUATION

The UN General Assembly recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realisation of all human rights.

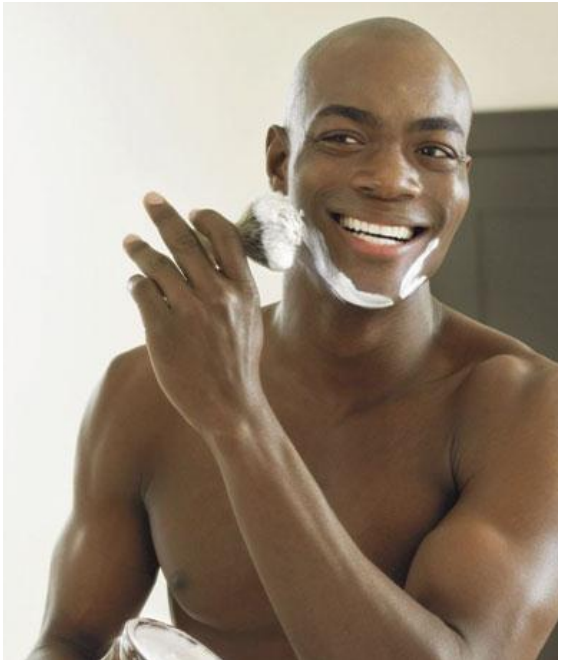
Resolution of the UN General Assembly, 28 th July 2010

663 million people without access to an improved drinking water source

2,4 billion people without access to improved sanitation

WATER AND SANITATION: CURRENT SITUATION

- **Disparities between developed and developing countries**



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WATER AND SANITATION: CURRENT SITUATION

- **Disparities between developed and developing countries**

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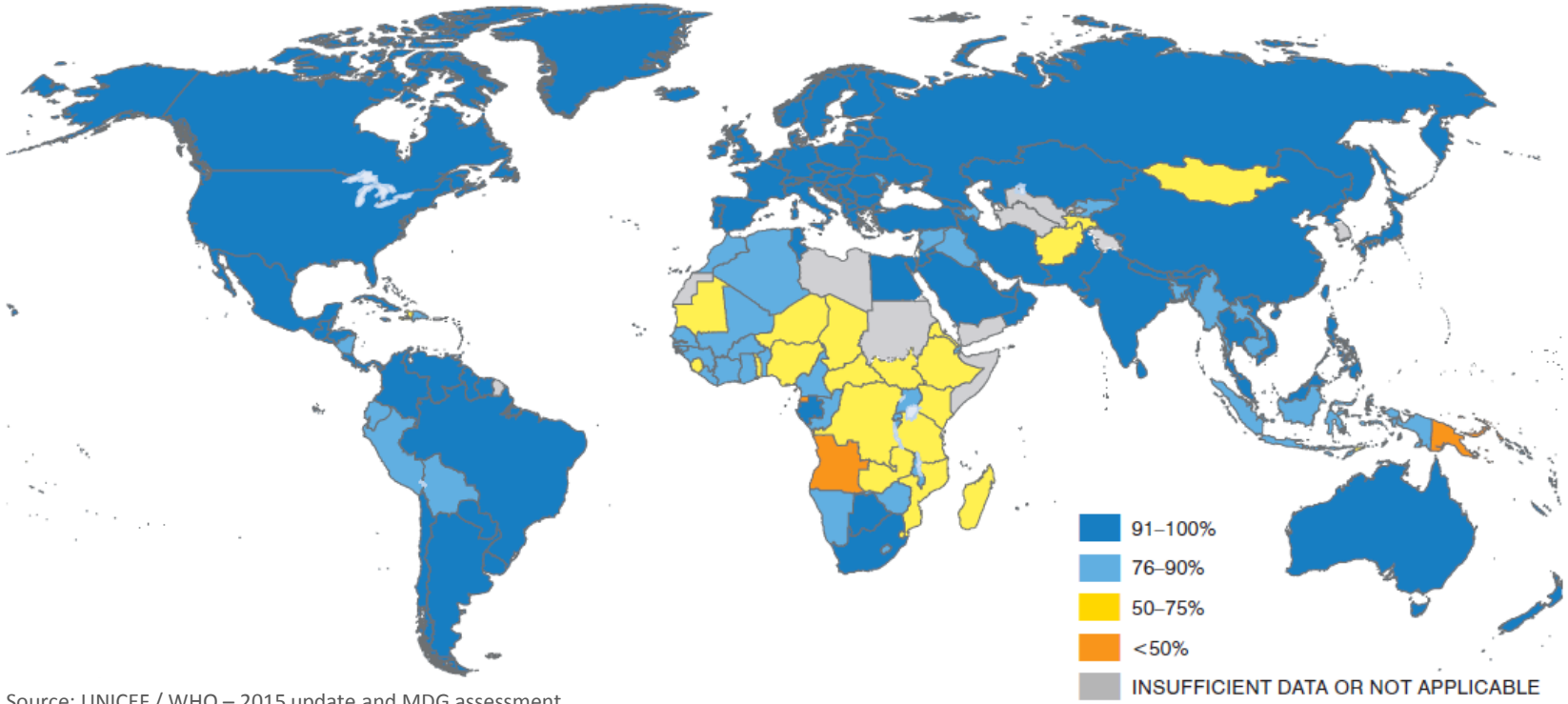
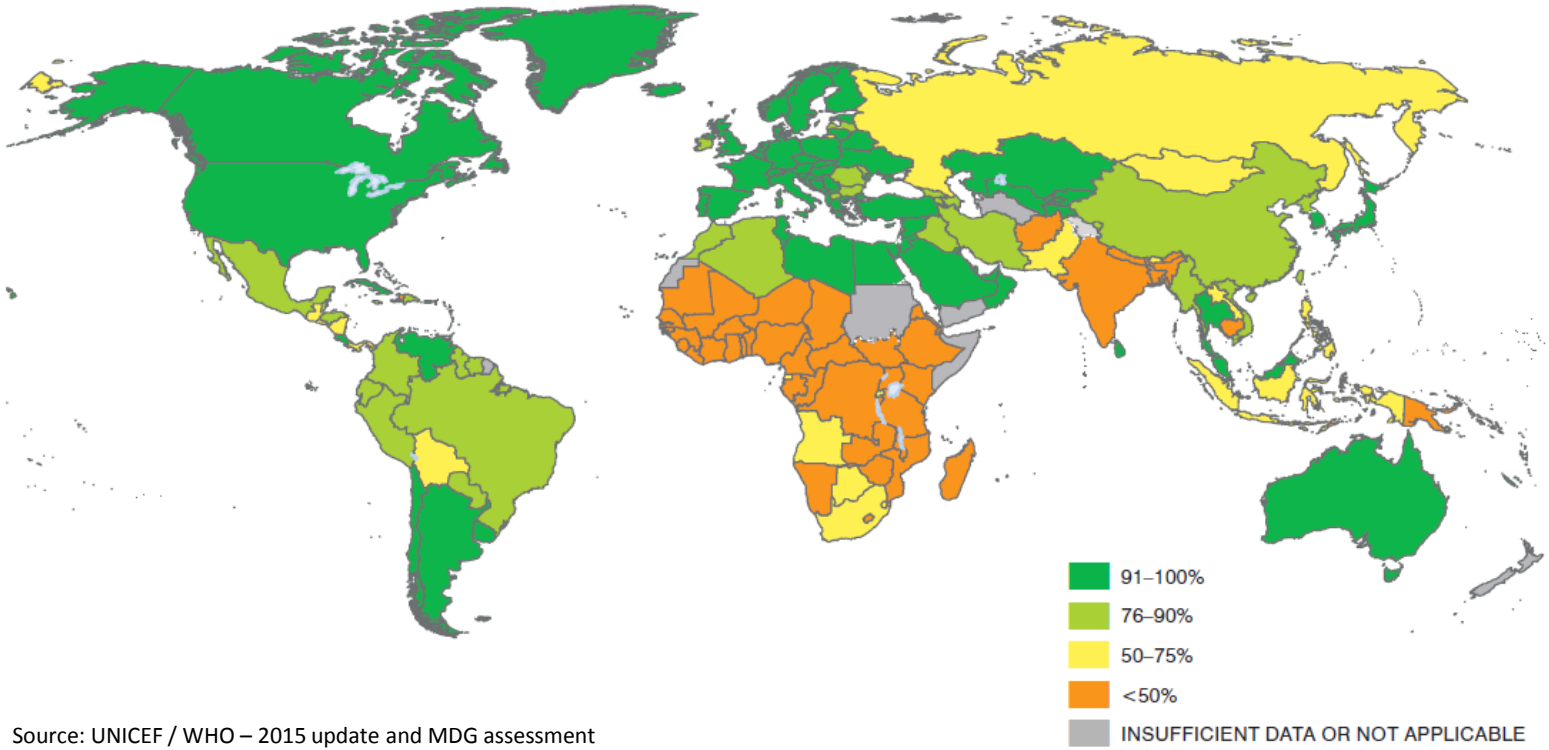
WATER AND SANITATION: CURRENT SITUATION

Proportion of the population using improved drinking water sources in 2015



Source: UNICEF / WHO – 2015 update and MDG assessment

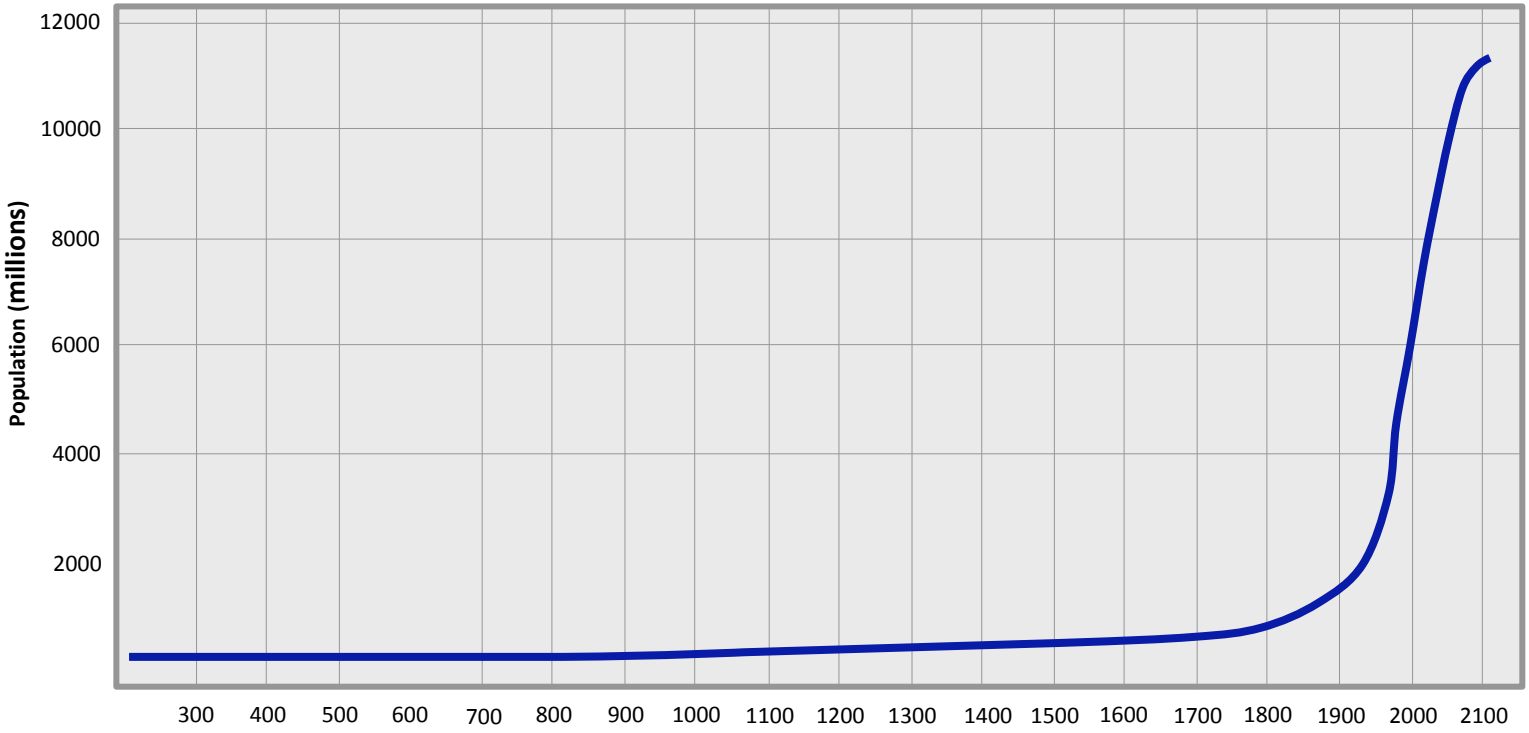
Proportion of the population using improved sanitation facilities in 2015



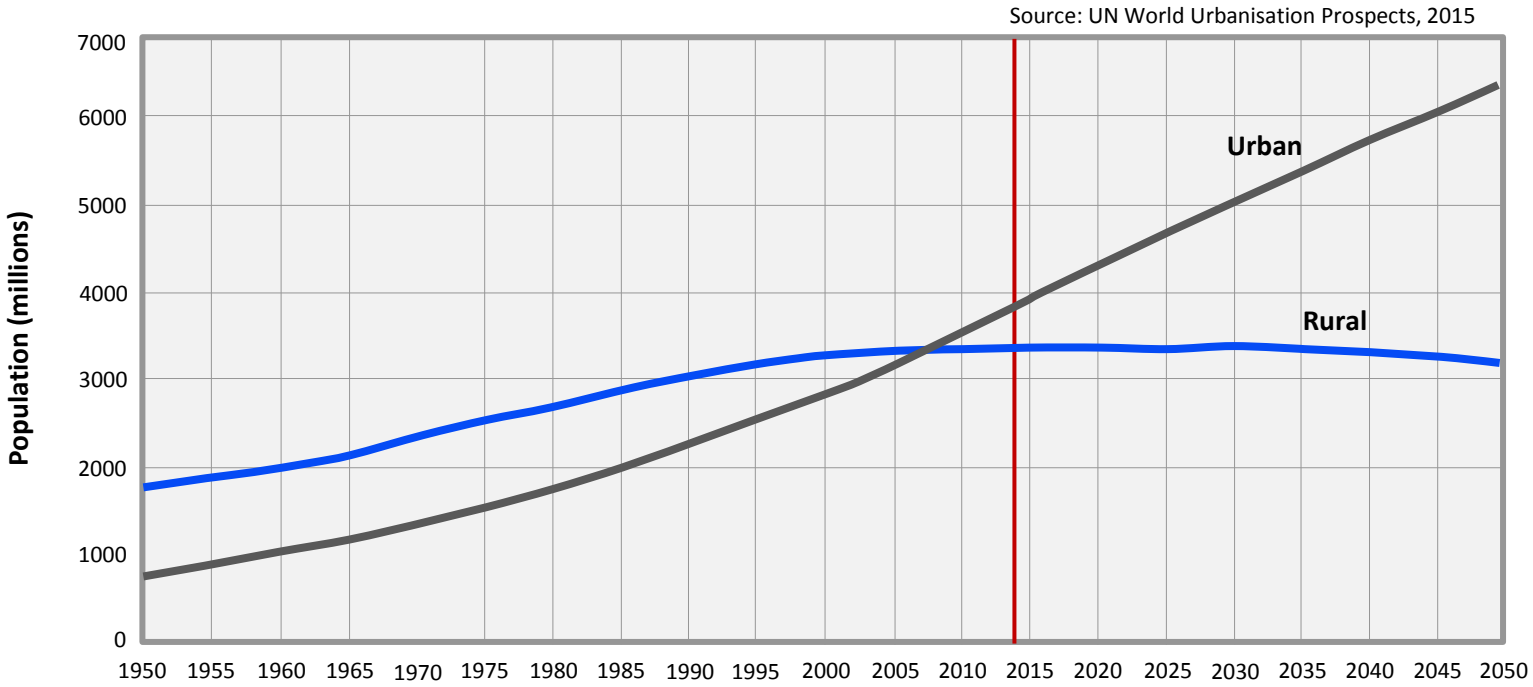
Source: UNICEF / WHO – 2015 update and MDG assessment

World population

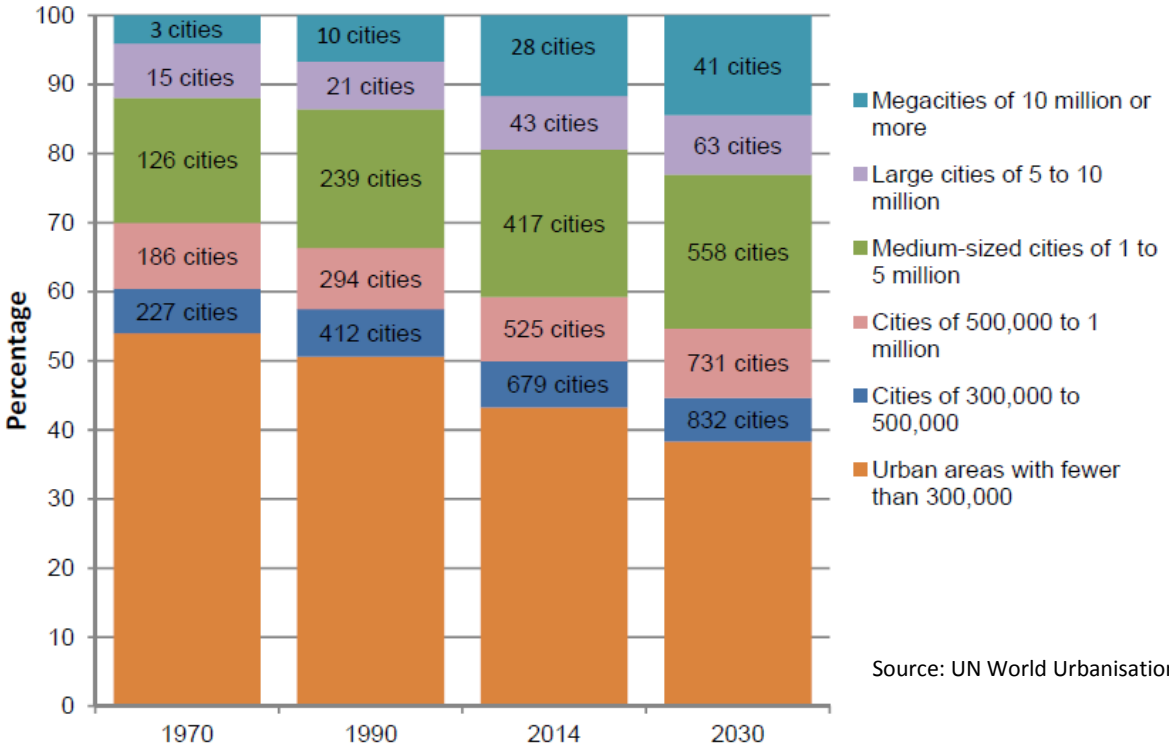
Source: UN World Urbanisation Prospects, 2015



World´s urban and rural populations



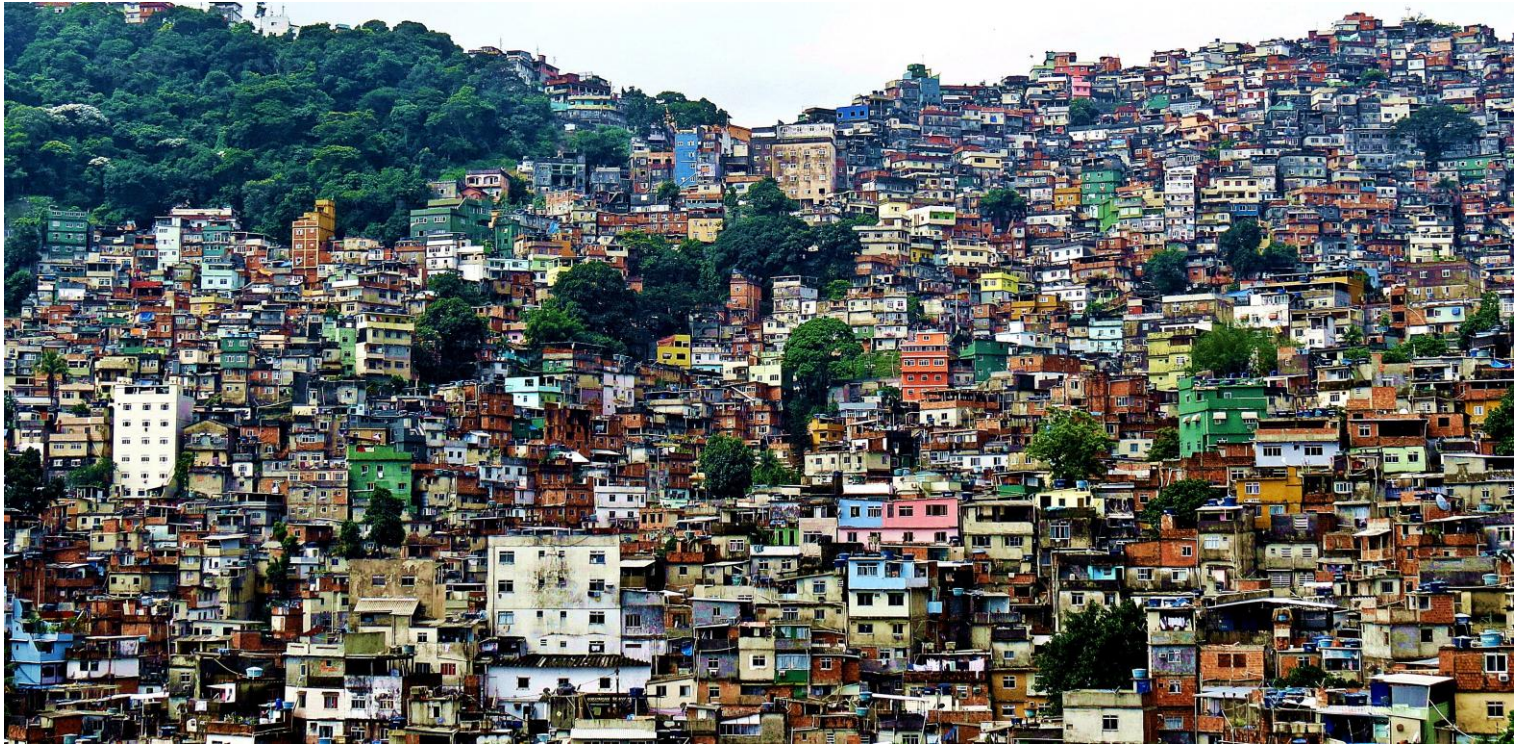
Distribution of the world´s urban population by size of urban settlement



Source: UN World Urbanisation Prospects, 2015

- **Population pressures on urban water**

Population pressures on urban water



- **Population pressures on urban water**

- **Climatic extremes and denser urban environments**

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- **Unsafe water sources due to industrial wastewater discharges**

- **Unsafe water sources due to sewage discharges**

- **Unsafe water sources due to chemical (toxic) substances (uncontrolled) discharges**

- **Emergent biological threats**
  - Well known diseases that may emerge
  - “New” diseases due to advanced detection laboratorial methods
  - True new diseases
  - Changes in diseases behaviour
  - Changes in environmental conditions
  - Diseases appearing in unexpected environments
  - Other aquatic microorganisms that can emerge

- **Emergent chemical threats**
  - Pharmaceutical residues
  - Endocrine disrupting compounds (DC)
  - Pesticides
  - Biocides
  - Algal toxines algais / cyanobacteria
  - Personal higiene products
  - …

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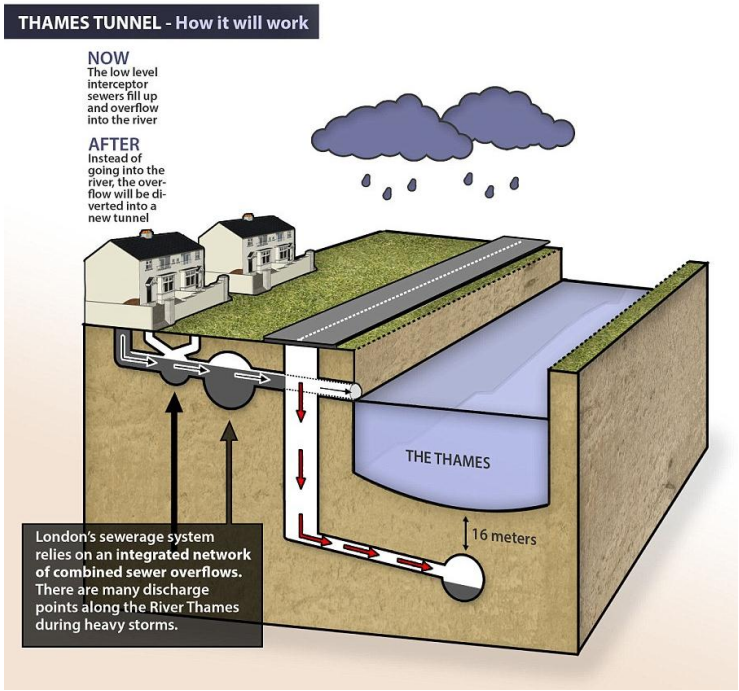
PUBLIC HEALTH: THE COMPLEX CHALLENGES OF THE CONTEMPORARY WORLD

What technological solutions for the future?



The blue planet

Is the development *still* sustainable?