

## How to 'Treat' Domestic Wastewater

Challenges in Applications of Integrated Water Resources Management  
Water and Environment Centre - 15-16 March 2010

Frans P. Huibers  
Irrigation and Water Engineering Group



## How to 'treat' wastewater?

... means ...

- How 'to handle' wastewater
- How 'to deal' with wastewater

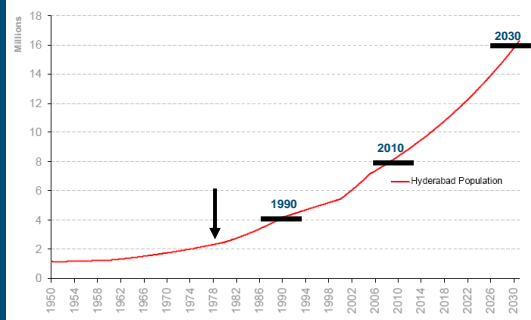


... and not ...

- Which treatment plant to construct



## Urban population in Hyderabad (India)



Picture: IWMI

## Increasing wastewater flows

Increase over a period of around 25 years:

- Population growth (3%) > x 2
- Urbanisation (3%) > x 2
- Economic development > x ?

What happened and will happen to Sana'a and other Yemeni cities???

- Last 25 years
- Coming 25 years

## 3 Approaches to 'treat' wastewater

- Discharge into natural waters or sinks
  - Leads to environmental pollution and economic damage at medium and long-term
- Construct WWTPs at secondary or advanced level
  - Leads to environmental protection, but at high costs
- Agricultural use
  - Immediate benefits, reduces environmental pollution

Country	Wastewater use (Mm <sup>3</sup> /day/million)	Renewable water resources (M <sup>3</sup> /cap/yr)
Yemen	3	125
Morocco	3	917
China	11	2104
Egypt	26	703
Jordan	40	153
Tunisia	51	452
Syria	55	791
Mexico	136	4214
Israel	166	252
Qatar	170	45

### The reality of wastewater use

- Wastewater is an increasingly important (and reliable) water source, replacing the use of fresh water resources (closing basins)
- Nutrients in wastewater may (partly) replace chemical fertilizers (recycling)
- Irrigation with wastewater is a treatment step (environmental protection)
- Many (poor) farmers depend on wastewater (livelihood)

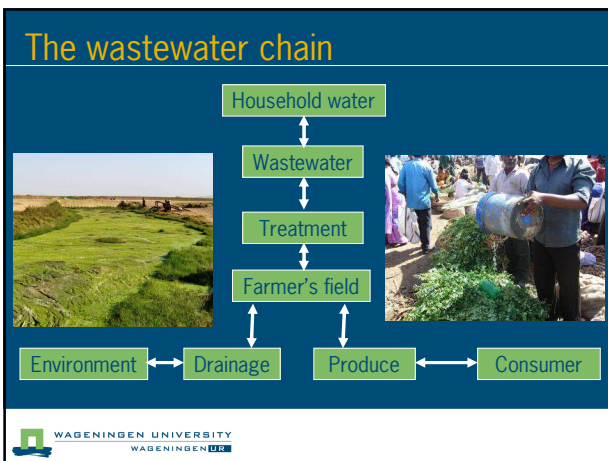
### Wastewater use (from safe to risky)

- Groundwater recharge
- Landscaping, incl. golf courses
- Industrial crops
- Fodder crops
- Food crops
  - Processed before consumption
  - Tree crops
  - Raw consumed vegetables



### Risks in using domestic wastewater

- Farmers:
  - helminth eggs (parasitic worms)
  - pathogenic bacteria
  - skin infections
- Consumers:
  - helminth eggs
  - pathogenic bacteria
- Environment:
  - nutrient uploading
  - salinisation/sodification (groundwater - surface water - soil)



### Upstream issues (collection and treatment)

- Separate domestic and industrial flows
- Collect wastewater in a sewerage system
- Transport to location where effluent can be used
- Favour a decentralised approach where feasible



## Create storage in irrigation scheme

- Link between treatment and agricultural use
- Stores effluent in excess of irrigation water use (operational; seasonal)
- Is a source of irrigation water in periods of high water demand
- Acts as buffer in case of calamities
- Can act as additional treatment



Different Irrigation Techniques



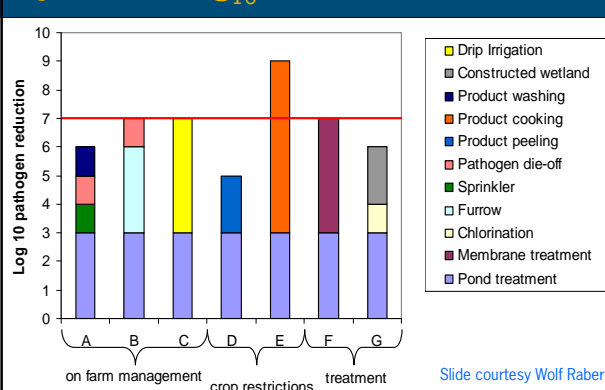
## Crop handling: Contamination risks



## Food chain: Market handling



## QMRA with log<sub>10</sub> reduction



## The reverse design approach

- Effluent quality fixed by the required water characteristics in downstream irrigation (negotiable)
- The location of the treatment plant in relation to the agricultural field and additional fresh water resources
- Decentralization in view of cost reduction and the exclusion of toxic waste streams in the sewerage
- The lay-out of the water distribution system, incl. the construction of irrigation water storage basins

## Research challenges

- Technological:
  - Design criteria for treatment plants serving agriculture
  - How to make irrigated agriculture a treatment step
- Environmental:
  - How to control health risks for farmers and consumers
  - What are long term effects on soil, surface- and groundwater
- Socio-economic:
  - Develop policies to properly involve stakeholders
  - How to create required knowledge and acceptance with farmers and consumers

## Aim: Make wastewater a resource!



**To you it's 'Shit'. To us it is BREAD AND BUTTER**  
**Shit Business is Serious Business**



## Thank You

Frans.Huibers@wur.nl

© Wageningen UR

