Understanding Wastewater Flow and Use

Key Questions

Where does wastewater go ?
What infrastructure exists ?
Who does what with wastewater ?

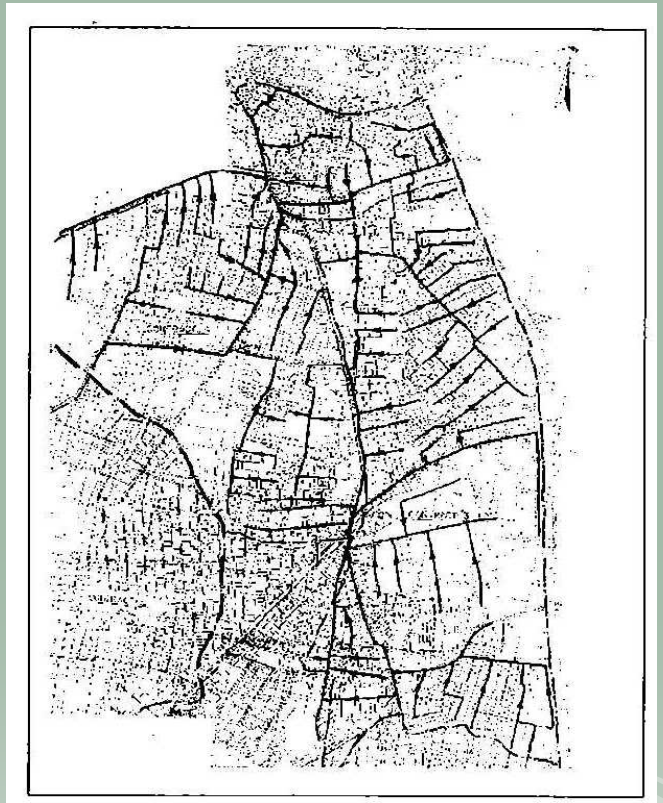
Module 2 Session 2

Covered in this session

- Where does wastewater go ?
  - Characteristics of a drainage system
- What wastewater infrastructure exists ?
- Who uses wastewater and how ?
  - Reuse of wastewater for food production

Where is Wastewater produced ?

- Wastewater management solutions must fit within the overall river basin or water catchment area geography and drainage pattern of the area.



a: All existing drains and drainage boundaries plotted

Drainage plan

Key questions

- What is the slope or fall within the area and how does this effect the drainage pattern
- Where does wastewater go to (discharge) and what is the capacity of the waterbody (lake, river, canal) to absorb pollution ?
- Is water extracted from the waterbody downstream of the discharge point ?

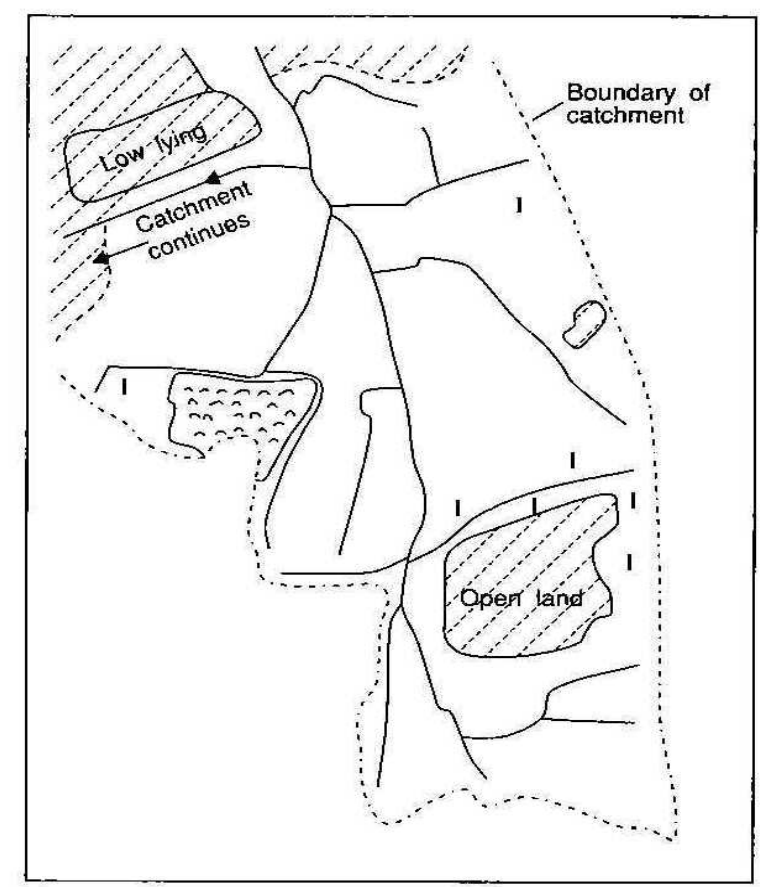
What Infrastructure exists ?

- Few towns and cities have **no** wastewater infrastructure. Canals and drains may form part of early city development. Drains may have been built as part of earlier schemes or as adhoc responses to drainage problems.
- What infrastructure exists and does it work ?

Overall plan of Shaoxing with historic core in red. Canal network in city core over 500 years old.

Existing Drainage Infrastructure

- Identify main drains and boundaries between drainage areas.
- Locate areas that are served by centralised sewerage/drainage systems.
- Identify local drainage systems with no wastewater collection



b: Main sewer routes identified

Who uses wastewater and how ?

Farmers use wastewater in agriculture throughout the world:

- it has been estimated that about 10% of the world's wastewater is used for irrigation of more than 20 million ha.
- in developing economies most of wastewater is used untreated.
- most wastewater use systems are gravity-fed, pumped or carried in watering cans. Most use flood or ridge and furrow irrigation. Some treated wastewater is distributed through sprinkler systems.

Extent of wastewater use – agriculture

- Crops may be grown in flooded fields or in series of elevated ridges separated by furrows or ditches
- Crops irrigated with wastewater are diverse: vegetables, cereals such as maize, rice and wheat, fruit trees, and fodder or grass for livestock
- Examples of countries with wastewater use in agriculture:
  - Developed world
    - Australia
    - Portugal
    - USA (Arizona, California, Florida)
  - Developing world
    - Africa (Ghana, Senegal)
    - Asia (Bangladesh, China, India, Vietnam)
    - Latin America (Chile, Mexico, Peru)
    - Middle East (Israel, Jordan, Kuwait, Saudi Arabia)

Extent of wastewater use - aquaculture

Wastewater use in aquaculture is less widespread than agriculture :

- although only as little as 30,000 ha may be wastewater-fed, it is locally important in some countries, especially in Asia
- China had 20,000 ha but the world's largest system is in Calcutta, India with 3,500 ha, followed by Hanoi, Vietnam with about 400 ha

Extent of wastewater use – aquaculture (continued)

- Cultured organisms are fish and aquatic plants, with fish for human food and aquatic plants either for human food (water spinach, water mimosa) or animal feed (water spinach, duckweed)

- Fish are cultured in ponds and aquatic plants either in ponds or staked in rivers polluted with wastewater

Untreated wastewater being used to irrigate vegetables in Thanh Tri district, Hanoi, Vietnam.

Untreated wastewater from a wastewater discharge canal is used to irrigate vegetables in the foreground but fish pond water is used for irrigation in the background in Kolkata, India

Irrigation of crops with treated wastewater from an activated sludge treatment plant in Titagarh, India

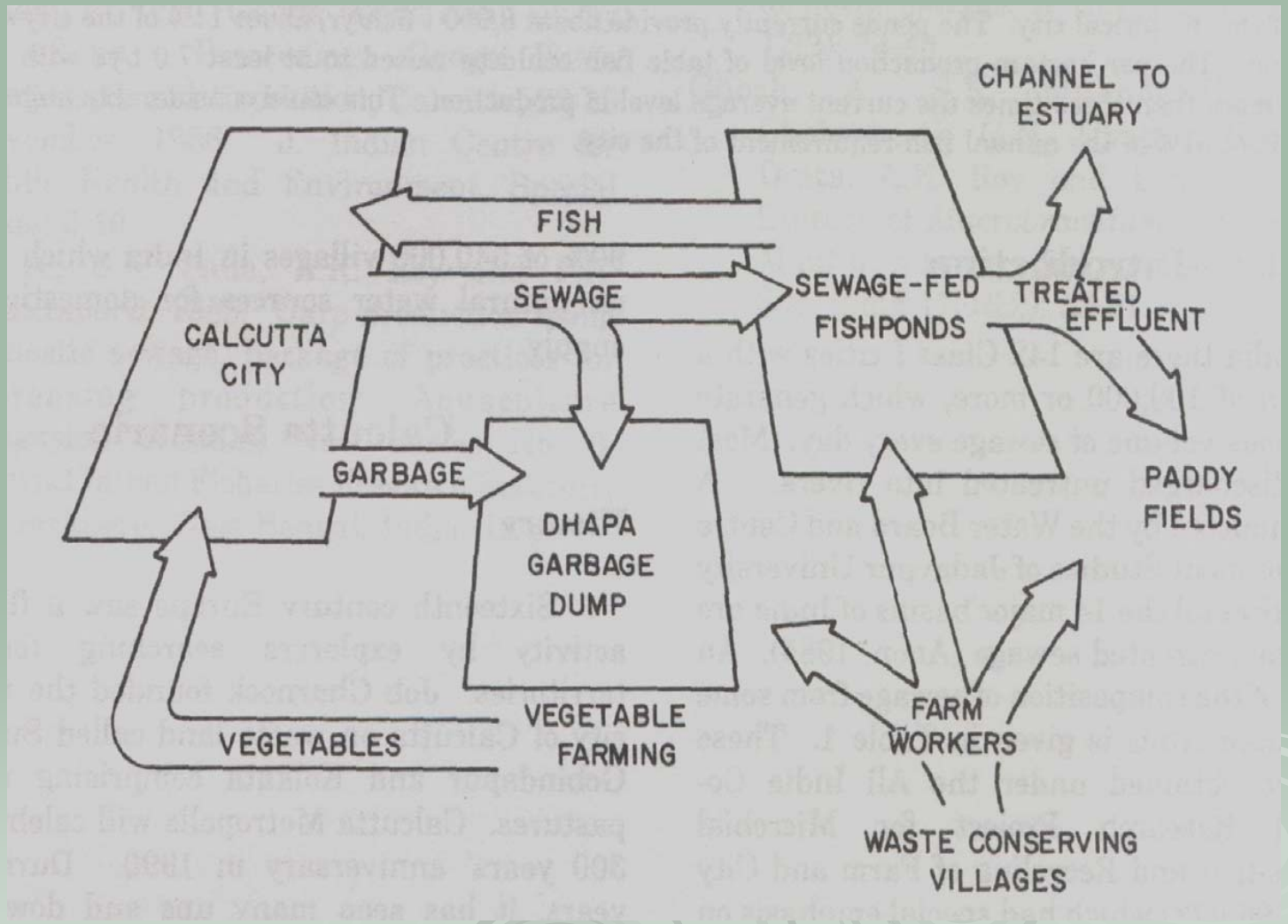
The treated wastewater is distributed to farms in Titagarh through concrete channels

Harvesting water spinach cultivated in wastewater in HCM city, Vietnam

Water spinach being harvested from a wastewater polluted lake in Phnom Penh

Water spinach harvested from a wastewater fed lake being transported to the market in Phnom Penh

The Kolkata use systems



Wastewater fed fish ponds in Kolkata, India. The major wastewater canal is in the foreground and the fishponds are in the background

Polluted surface water being pumped out of the river for use in fish ponds in Thanh Tri district, Hanoi, Vietnam

Livelihoods

Many people, especially poor people, depend for their living or livelihood on wastewater use:

produce from wastewater use is used for household consumption as well as for employment and income generation

- many farmers involved in wastewater use have an insecure life :
  - they may have several jobs as income from wastewater use is insufficient to meet their needs
  - they often farm without tenure or ownership of land or water and face possible eviction through urban expansion
  - They have limited knowledge of safe practice in wastewater use which threatens public health
- wastewater use as a livelihood option is rarely appreciated by government

Gender

Women tend to be a disadvantaged group in most developing countries as compared to men they have :

- fewer opportunities
- lower status
- less power & influence

Gender equality is essential to poverty elimination as :

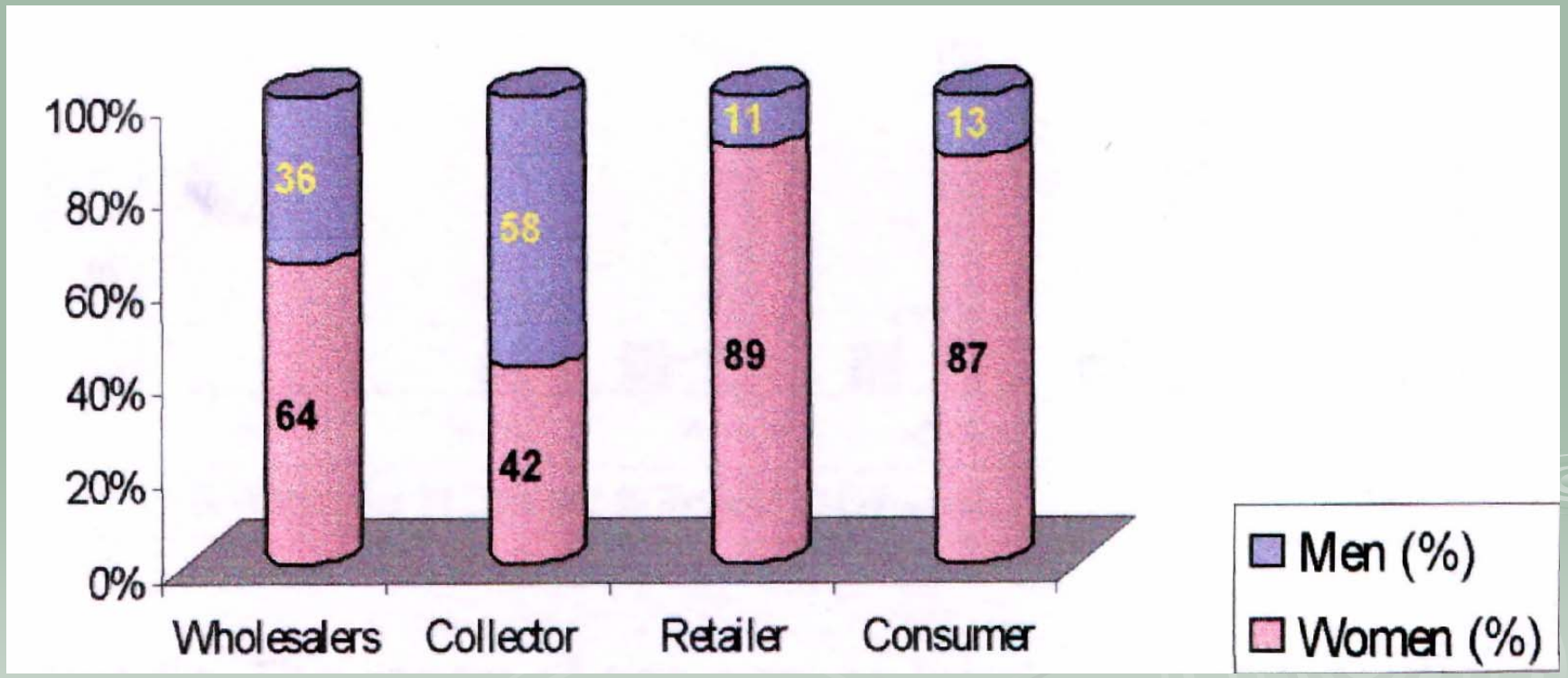
- women bear the brunt of poverty
- the empowerment of women is central to the elimination of poverty

Gender (continued)

Two examples are given of women's involvement in wastewater use :

- a higher proportion of women than men are engaged in wastewater use in agriculture in India as males can take advantage of higher paying off-farm employment and avoid health hazards associated with use of wastewater
- women play a considerably larger role than men in marketing fish and aquatic plants in periurban Hanoi

Gender in fish trade in Hanoi



Gender in aquatic plant trade in Hanoi