



# Setting the tone: The importance of water and its management

Centre for Science and Environment



# Twin challenges

- **Rapid urbanization** – massive growth in cities in the global South; means more water for their needs and more waste
- **Climate change** – increased weather variability
- **Problem** is that our pattern of urbanization and with it pattern of water-waste management is **highly resource intensive; capital intensive**
- Leading to inequity; unsustainability



# NOT ALONE

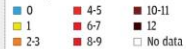
# But inevitable?



# Global SINKS

Ten metropolitan cities of the world that are on the verge of an imminent water crisis

Number of months in which water scarcity is >100%



● 200 water-stressed cities of the world

## Mexico City, Mexico

Annual population growth: 1.5%

Source: Surface and groundwater

Crisis: The city extracts three times more groundwater than it can recharge. The over-exploitation of groundwater is causing land subsidence, making the city prone to flooding. The supply infrastructure is very poor, with 40% distribution loss

## Karachi, Pakistan

Annual population growth: 5%

Source: Surface and groundwater

Crisis: Huge influx of rural population to urban. The pipe lines are over 40 years old, with 25 per cent distribution leakage. Over 50% of the population in the city lives in informal slums, which are not connected to the piped supply. Wastewater from slums seeps and contaminates shallow aquifers

## Kabul, Afghanistan

Annual population growth: 0.2 million

Source: Groundwater

Crisis: 68% of Kabul residents don't have access to piped water and just 10% have access to potable water. Over-extraction of groundwater has reduced the water table

## Istanbul, Turkey

Annual population growth: 1.3%

Sources: 10 dams in the Marmara and the Black Sea regions and groundwater

Crisis: By 2020, the demand supply gap will reach 607 million m<sup>3</sup> per year. The decline in the water table due to unsustainable extraction is as much as 150 m in some areas and has led to salt water intrusion in coastal areas

## Nairobi, Kenya

Annual population growth: 3%

Source: Dams, springs, aquifers.

Crisis: A water deficit of 0.2 million cubic metres per day. Only 50% of households are connected to a distribution system, where leakage loss is 50%. Waterbodies are highly polluted due to dumping of raw sewage

## Buenos Aires, Argentina

Annual population growth: 1%

Sources: La Plata river, groundwater

Crisis: Over-extraction of groundwater near the sea has led to saltwater intrusion, making groundwater non-potable. Only 5.8% sewage treated, rest discharged in the city's waterbodies

## Sao Paulo, Brazil

Annual population growth: 1%

Sources: Six reservoirs

Crisis: The city loses 30% of its treated supply to leaks. The two main rivers are heavily polluted and rainfall destruction has reduced precipitation

## Beijing, China

Annual population growth: 3.9%

Sources: Mainly groundwater

Crisis: In 2012, its water use was over 3.6 billion m<sup>3</sup>, against the available 2.1 billion m<sup>3</sup>. The available water per person is only about 3% of the world's average. Due to over-extraction of groundwater the city has been sinking

## Bengaluru, India

Annual population growth: 3.5%

Source: Cauvery, Arkavathy rivers, groundwater

Crisis: Rivers and groundwater are the main sources. The total number of extraction wells has shot up from 5,000 to 0.45 million in the past 30 years. The water table has shrunk from 10-12 metre (m) to about 76-91 m in just two decades. Recharge of groundwater is minimal due to unplanned urbanisation. The city only uses half of its treatment capacity to treat the waste and as a result a substantial amount of waste is dumped in the waterbodies

## Sanaa, Yemen

Annual population growth: 7%

Source: Mainly groundwater

Crisis: The city has to dig to 200-300 m in search of water and has dug into the fossil aquifer, which, estimates say, will be over in a decade. Less than 50% of the population receives piped water and leakage loss is 60%



Prepared by DTE/CSE Data Centre

Infographics: Raj Kumar Singh; Analysis: Sushmita Sengupta  
Source: The United Nations World Water Development Report 2017; Martina Florke et al. 2018. Water competition between cities and agriculture driven by climate change and urban growth, Nature Sustainability





# Around 200 cities running out of water

- ❑ Nairobi – Sources of water – Dams, springs and aquifers. Faces water deficit of 0.2 million cubic metres per day
- ❑ Bengaluru – Sources of water - Rivers and groundwater are the main sources. The total number of extraction wells has shot up from 5,000 to 0.45 million in the past 30 years. The water table has shrunk from 10-12 metre (m) to about 76-91 m in just two decades. Recharge of groundwater is minimal due to unplanned urbanisation
- ❑ Sanaa, Yemen – Source of water – Groundwater. The city dug 200-300 m down in search of water and even reached the fossil aquifer – which will be over in a decade



# Climate risked world increased vulnerability

- Climate change **is real**
- Resulting in increasing extreme and variable weather events
- Add to this
- Our mismanagement of water **is real**
- Resulting in water scarcity; pollution; flood and crisis of health and loss of livelihood



# Water wisdom is key

- Rain will be seasonal; more variable
- Cities will need more water for growth
- Industries will need more water for growth
- But cities and industries will, if we do not, plan today and differently, **use clean water and discharge untreated waste water**
- Pollution will increase
- Water scarcity will increase



# Question?

- Is the current system of water-waste management in cities appropriate for us?
- Can we build **water-secure Africa** or Asia if the system is designed so that it can meet the needs of some and not all?
- Can we do this in this age of climate change-risk unless we rethink and rework the system to **plan for all** and to **plan for sustainability**





# Paradigm of water

Water sourced from further and further away

Leads to increasing cost of supply

Leads to high distribution losses

Distribution loss means less water to supply at end of pipeline

Less water means more costly water

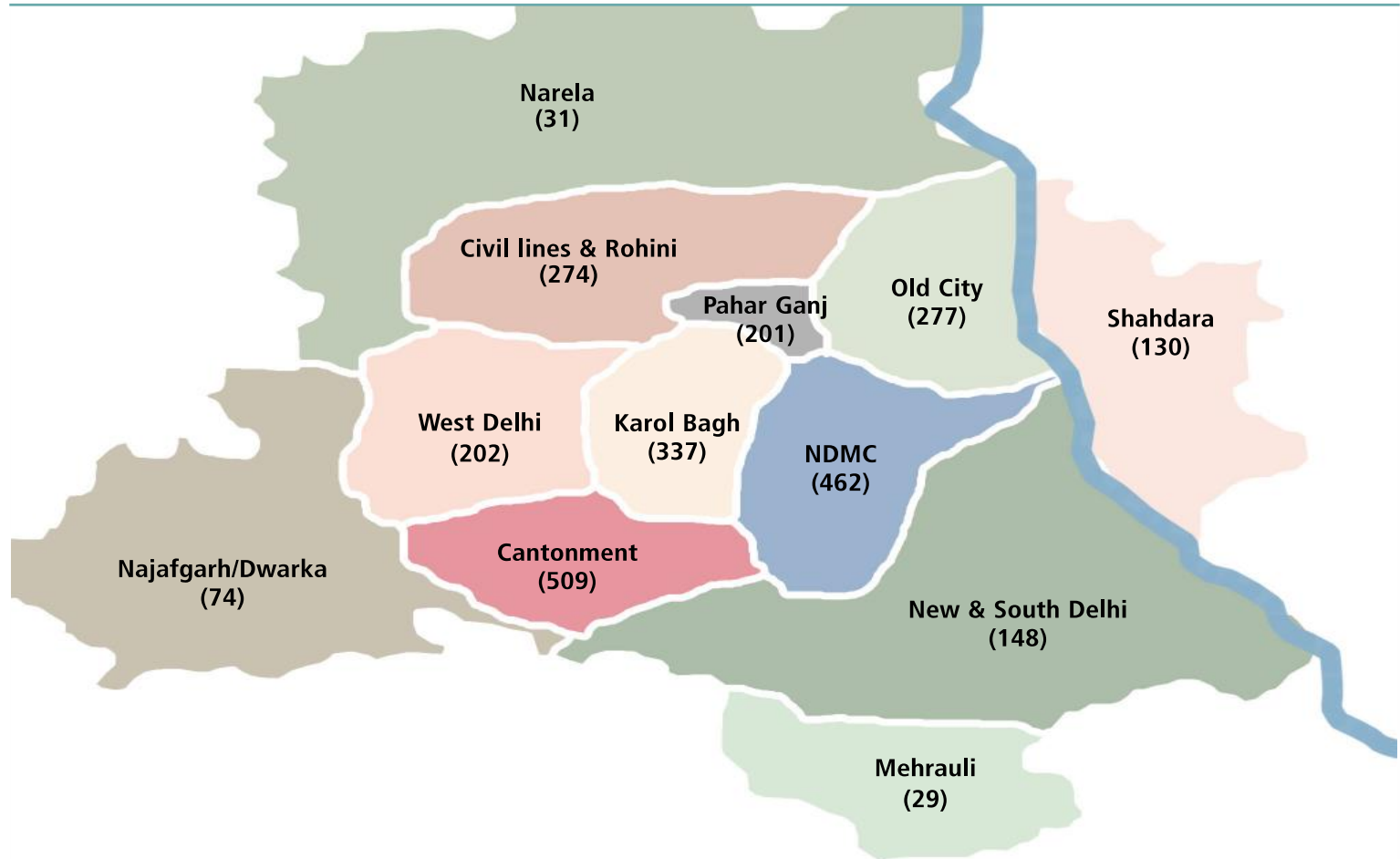
Cannot supply to all or take back waste of all

**Leads to inequity** (Cape Town: 15% people get 4% water supply)



# = 'Official inequity'

## DELHI: CAPITAL INEQUITY (IN LPCD)



LPCD: Litres per capita daily; NDMC: New Delhi Municipal Corporation

Source: Sunita Narain *et al* 2007, *Sewage Canal: How to Clean the Yamuna*, Centre for Science and Environment, New Delhi



# Groundwater: **abused**

When water supply does not reach **poor** people  
use groundwater

When water supply tariffs increase **rich** people use  
groundwater

But this is not accounted for

Cities only consider 'official' groundwater use

Millions depend on private wells, tanker mafia,  
bottled water

**No recognition** of this water source; **no respect** for  
its management

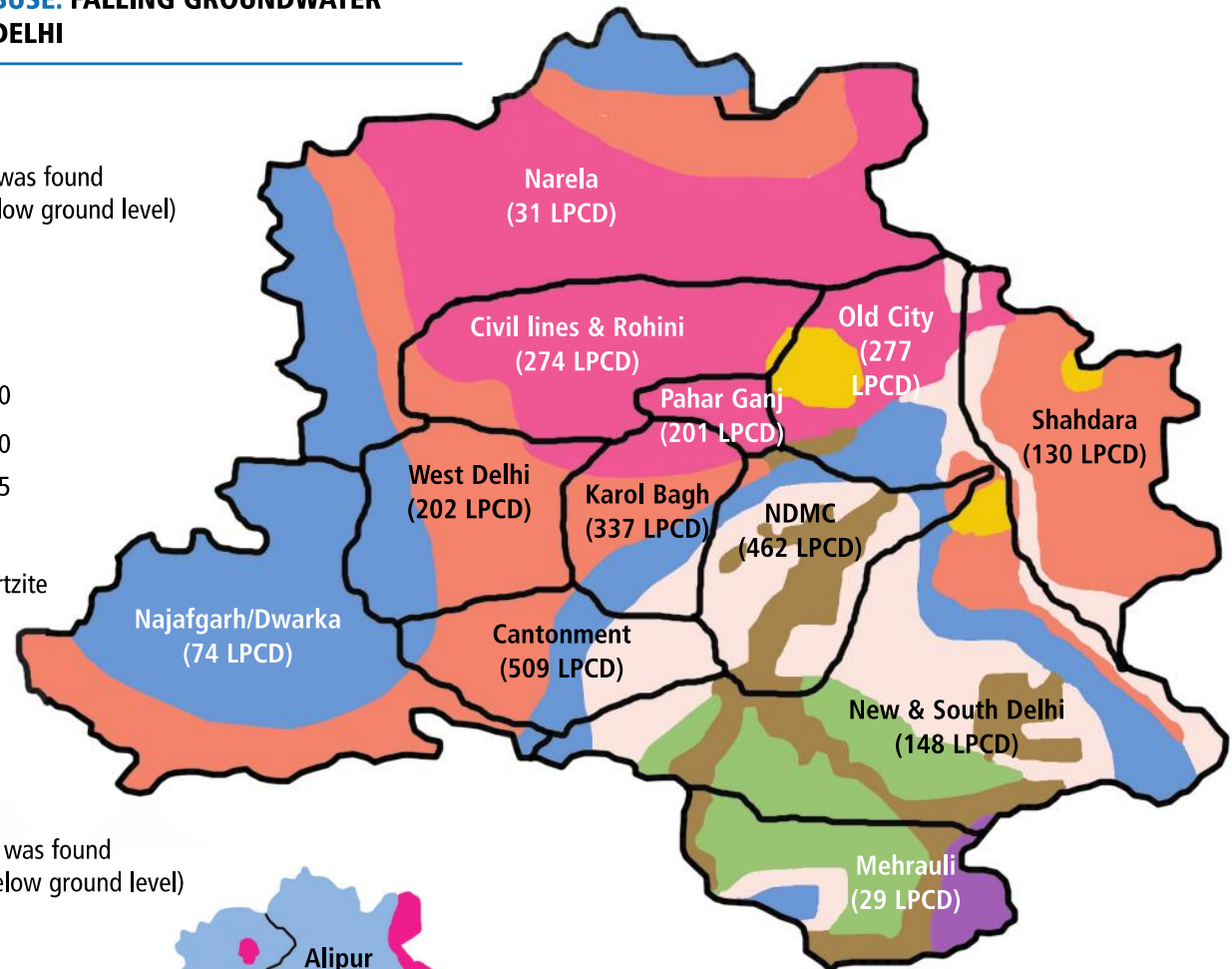


Where  
pipeline  
does not  
reach  
People  
depend on  
groundwater  
Falling  
groundwater  
levels tell us  
about  
inequity

## AQUIFER ABUSE: FALLING GROUNDWATER LEVELS IN DELHI

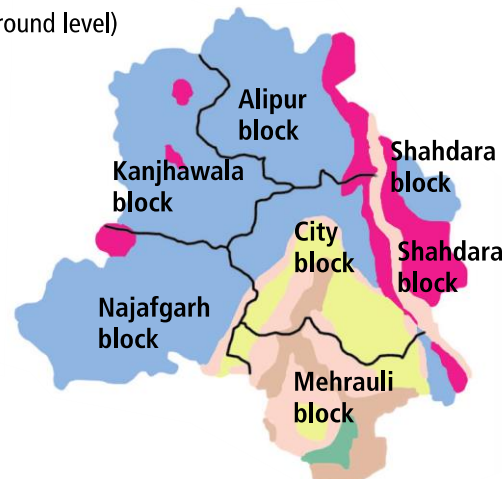
### MAY 2002

Where water was found  
(in metres, below ground level)



### 1960

Where water was found  
(in metres, below ground level)



LPCD: Litres per capita daily  
Source: Central Ground Water Board, 2002



# Present and future **lost**

Groundwater recharge requires **local recharge**

But waterbodies are discounted. Not considered part of water system

Water bodies in cities are critical to hold excess rainwater during floods; recharge groundwater

With climate change role of **sponges** more critical

Otherwise we go **from floods to droughts**



# Water=waste

**Cities plan for water, forget waste**

80% water leaves homes as sewage

More water=more waste

But cities rarely have funds to take back waste of  
all, treat waste of all and then re-use and recycle  
waste of all





# Partial treatment=pollution

The current water-sewage is both capital intensive and resource intensive

We can take the waste of some in our cities connect it to underground pipes, transport it to treatment plants, even treat the waste and discharge clean water to rivers

But cost of this system is high

**So we can subsidize the treatment of waste of some and not all**



# Inequity=pollution

- If system cost is unaffordable for all then it will be unsustainable for all
- If we cannot take back the **waste of all** and treat it then it will be mixed with the treated **waste of some**
- **= Pollution of our rivers and waterbodies**



# Agenda for water wise

- Have to reduce cost of water supply
- Requires cutting length of pipeline
- Requires ensuring cost of treatment of water is kept low (pollution is low)
- Requires recharge of groundwater for supply of local water
- Bottom-line: cut costs so that we can supply to all and take back waste of all



# **Agenda:** focus on wastewater

- Focus on wastewater and not just on water
- This is where our opportunity is
- Current system is about bringing water (long distance) and then taking back waste (long distance)
- Today we need plan to **reuse and recycle wastewater** -- every drop to be converted back to water. We do not **consume** water



# Agenda: Reuse waste

- In many parts of our world people are disconnected from official pipelines
- This 'on-site' waste treatment is not part of problem but part of new solution
- Today waste from on-site systems taken and discharged into waterbodies. Leading to pollution
- But can this waste be collected and put back on land?



# Agenda: Re-invent Re-work

1. Plan deliberately to **cut costs** of water supply
2. Invest in local water systems
3. Reduce water demand
4. **Spend on sewage** not on water
5. Cut costs on sewage systems by making on-site part of the off-site. Investing in wastewater treatment
6. Recycle and reuse every drop
7. Plan for all and not for some





# Critical

- Water is about societies wisdom to live with scarcity and excess
- Water availability is in our hands
- Requires us to do things differently – very differently
- **Water management is about courage and our politics. To plan for all. To deliver for all**
- **Sustainability not possible without equity**