Energy and Resource Efficiency
in
Urban Water Management

Challenges & potential for enabling paradigm shift under NURM

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CSE CCBP NURM Regional Workshop
at
Goa

CSE's Recent Publication

Volume 1 - dwells on how urban India is soaking up water, polluting rivers and drowning in its own waste (296 pages).

Volume 2 - contains a very detailed survey of 71 cities, and presents an assimilation of the survey's results (496 pages).

http://cseindia.org/content/excreta-matters-0

Structure of the Presentation

- Summary assessment of water (and sewage) management in India CSE's recent publication – Excreta Matters (2012) and earlier backgrounder

- Challenges & Potential for Paradigm Change –

  Mainstreaming Energy & Resource Efficient Urban Water Management Best Practices in ULBs.

The water-sewage connection

The conventional way:

Bring water into the city – storage, diversion, pipe, pump, treat – from further and further away.

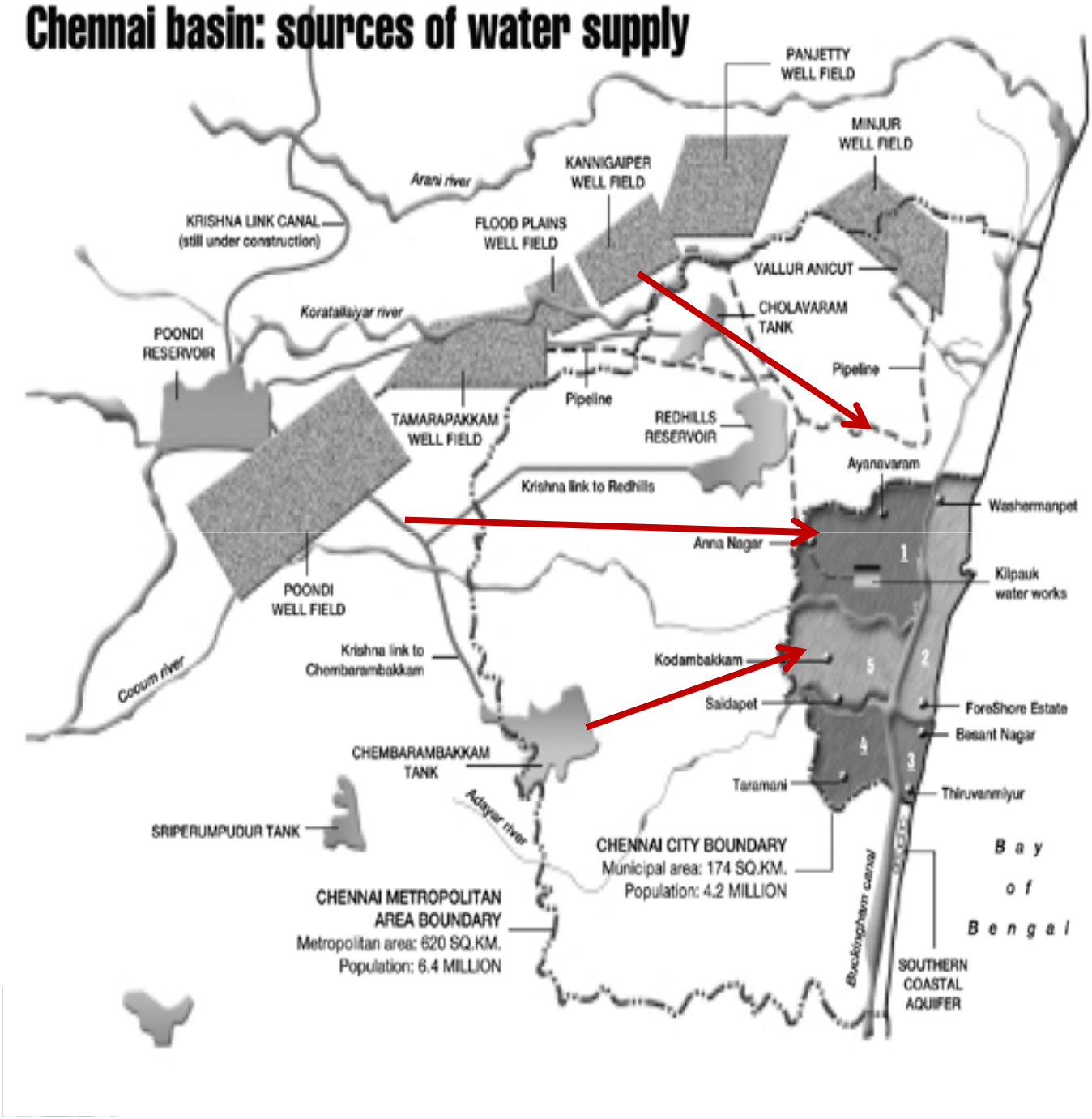
Flush and carry the waste out of the city – pipe, pump, divert, treat – further and further away.

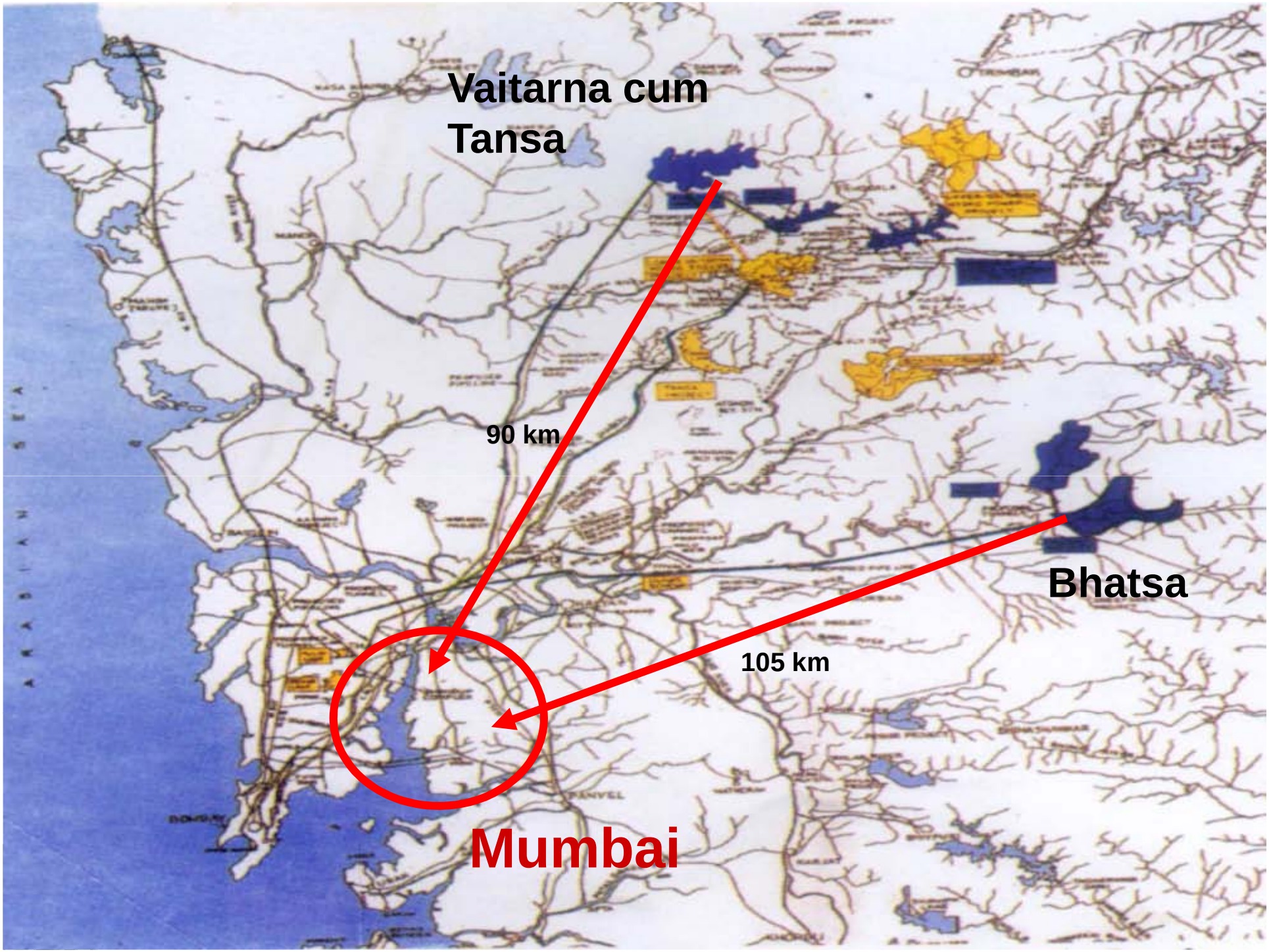
Not even single city has 24-7 water supply

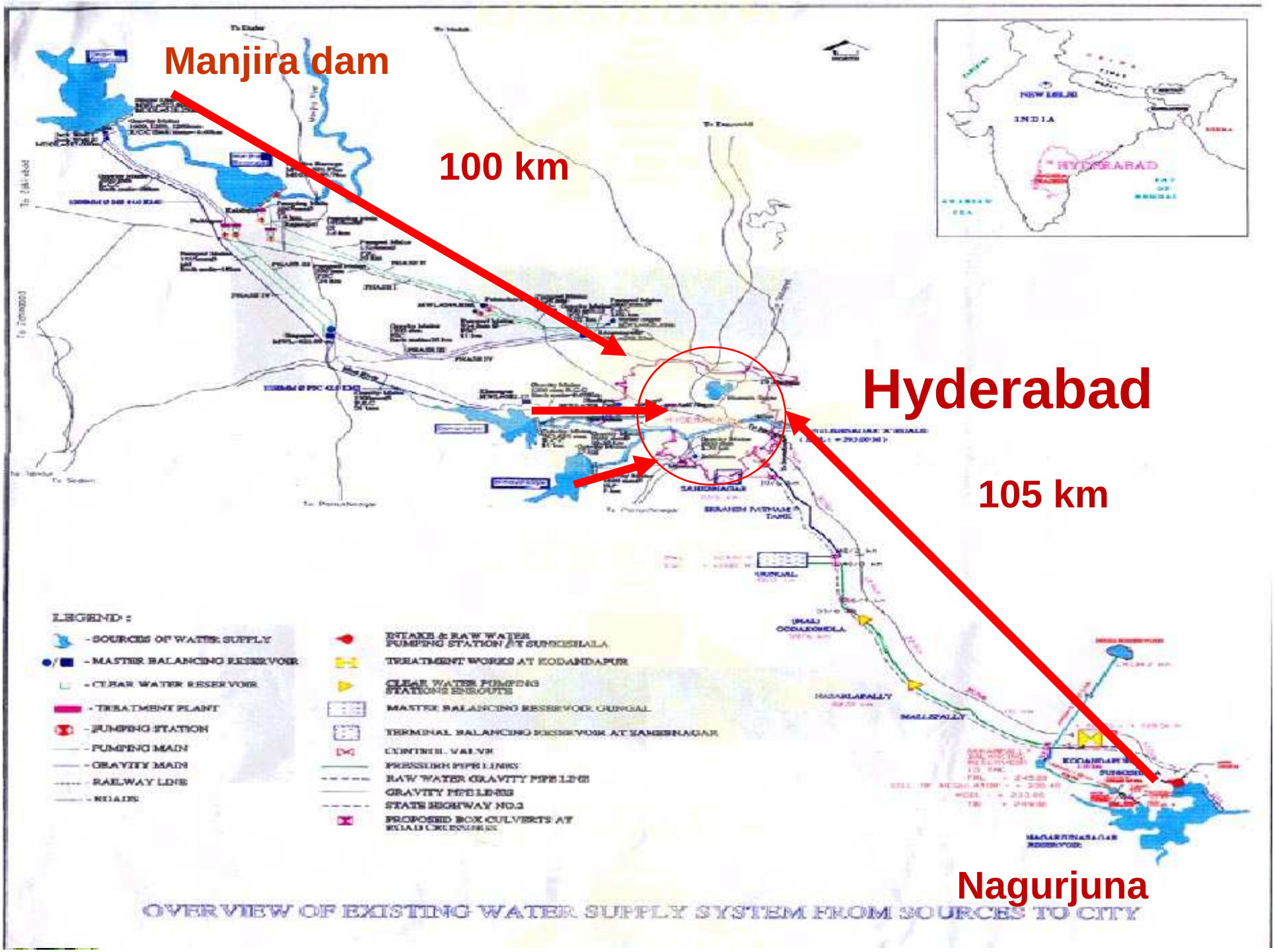
Location of WTPs and Sources of Water - Delhi

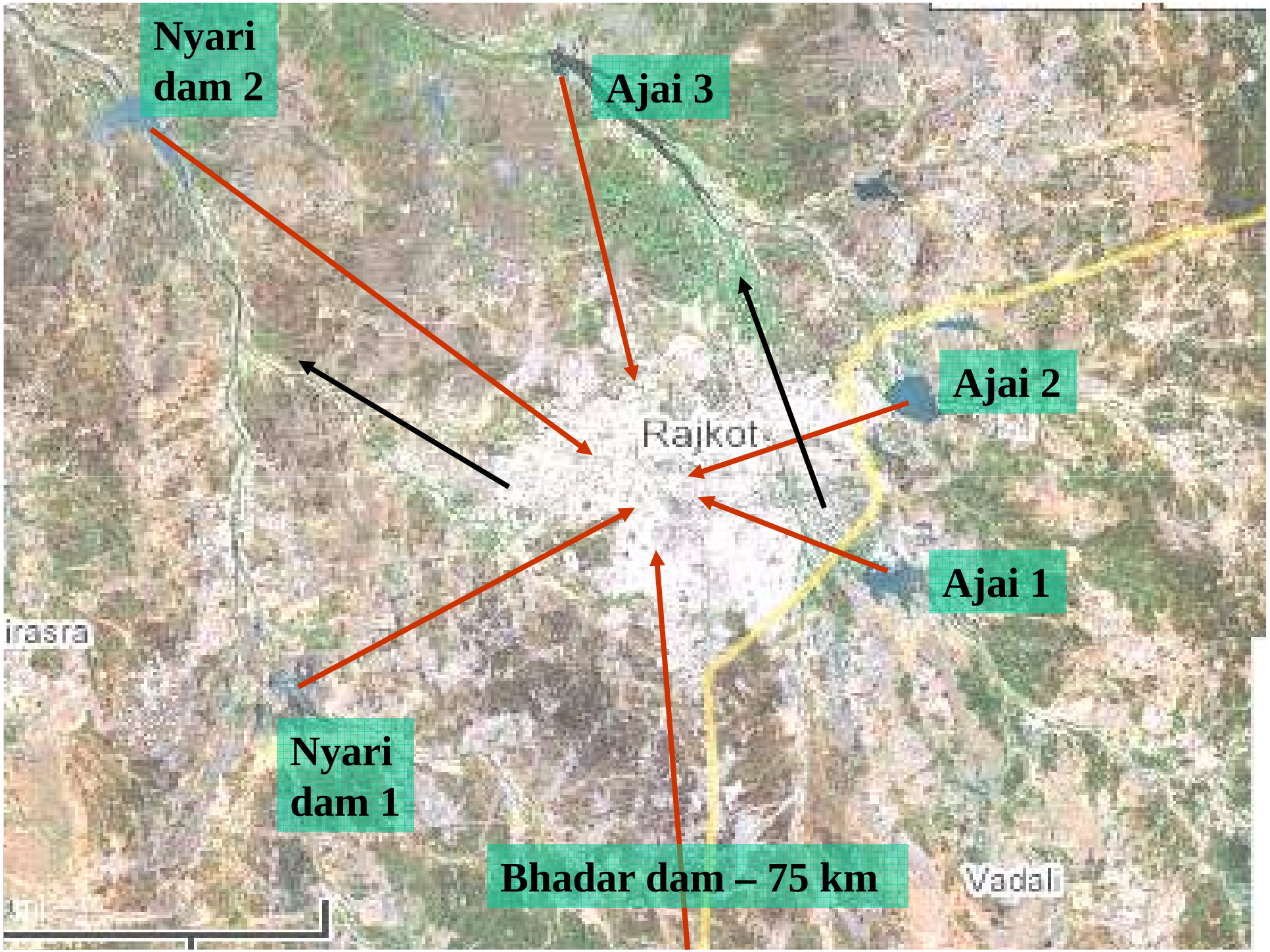
Above 250 kms

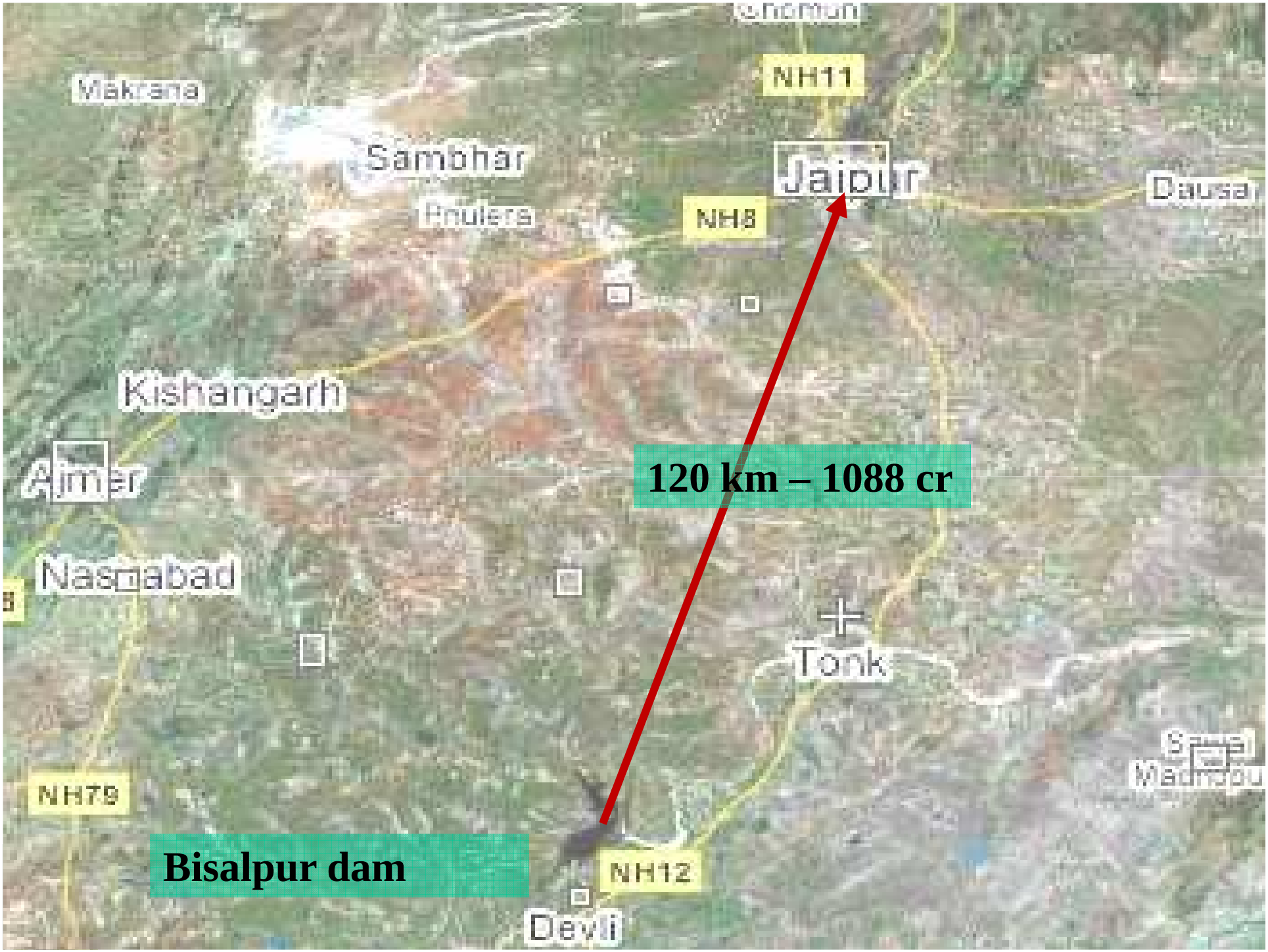
Relentless search for water

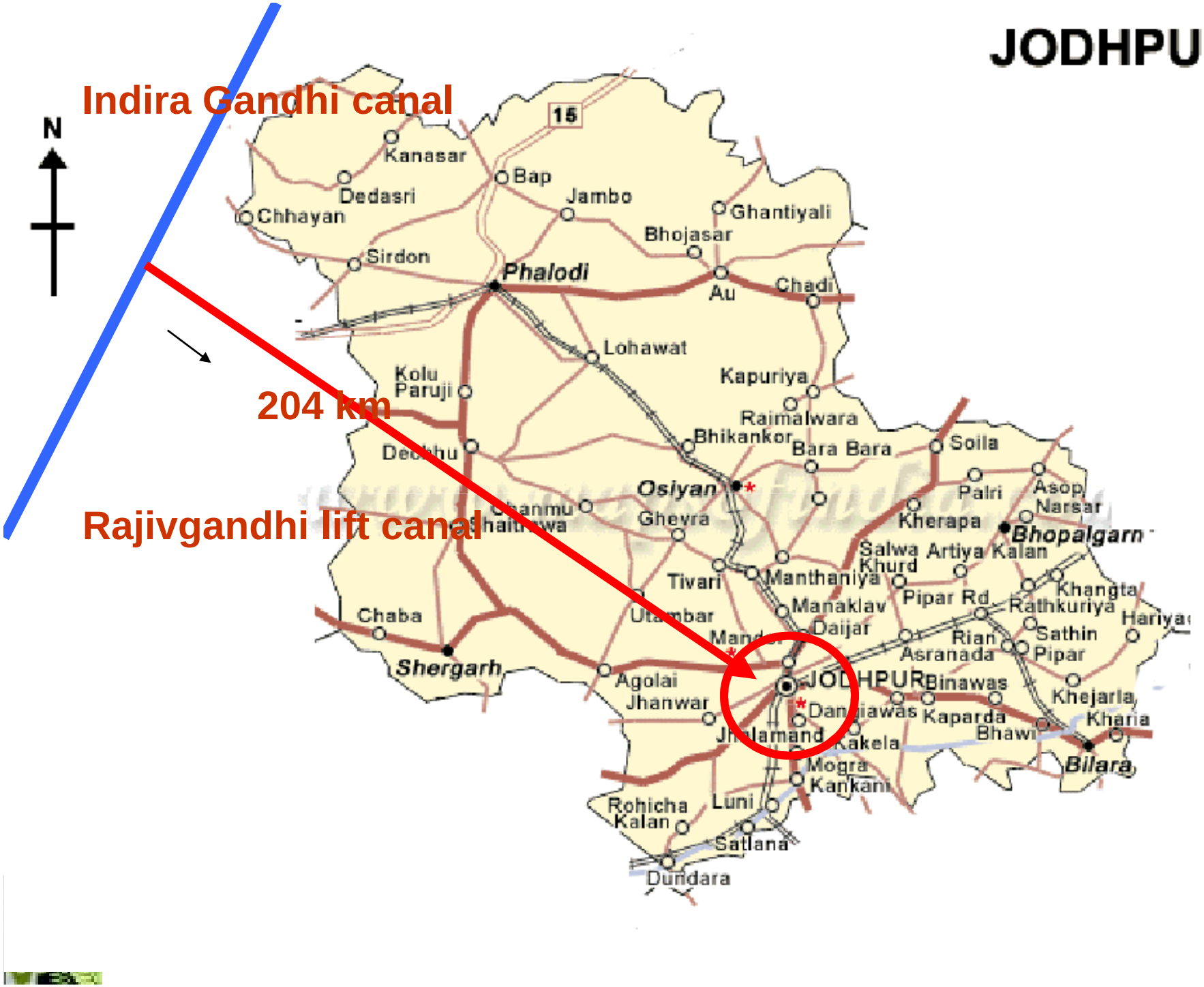



Vaitarna cum
Tansa
90 km
Bhatsa
105 km
Mumbai


Manjira dam
100 km
Hyderabad
105 km
Nagurjuna
INDIA
HYDERABAD
LEGEND :
- SOURCES OF WATER SUPPLY
- MASTER BALANCING RESERVOIR
- CLEAR WATER RESERVOIR
- TREATMENT PLANT
- PUMPING STATION
- PUMPING MAIN
- GRAVITY MAIN
- RAILWAY LINE
- ROADS
INTAKE & RAW WATER PUMPING STATION AT SUNGEELALA
TREATMENT WORKS AT KODANDAPUR
CLEAR WATER PUMPING STATIONS ENROUTE
MASTER BALANCING RESERVOIR GUNGAL
TERMINAL BALANCING RESERVOIR AT SANGEENAGAR
CONTROL VALVE
PRESSURE PIPE LINES
RAW WATER GRAVITY PIPE LINE
GRAVITY PIPE LINES
STATE HIGHWAY NO.3
PROPOSED BOX CULVERTS AT ROAD CROSSINGS
OVERVIEW OF EXISTING WATER SUPPLY SYSTEM FROM SOURCES TO CITY


Nyari dam 2
Ajai 3
Ajai 2
Rajkot
Ajai 1
irasra
Nyari dam 1
Bhadar dam – 75 km
Vadali


Makrana
Sambhar
Phulera
NH11
Jaipur
NH8
Dausa
Kishangarh
Ajmer
Nasirabad
120 km – 1088 cr
Tonk
Sawai Madhopur
NH79
Bisalpur dam
NH12
Devli

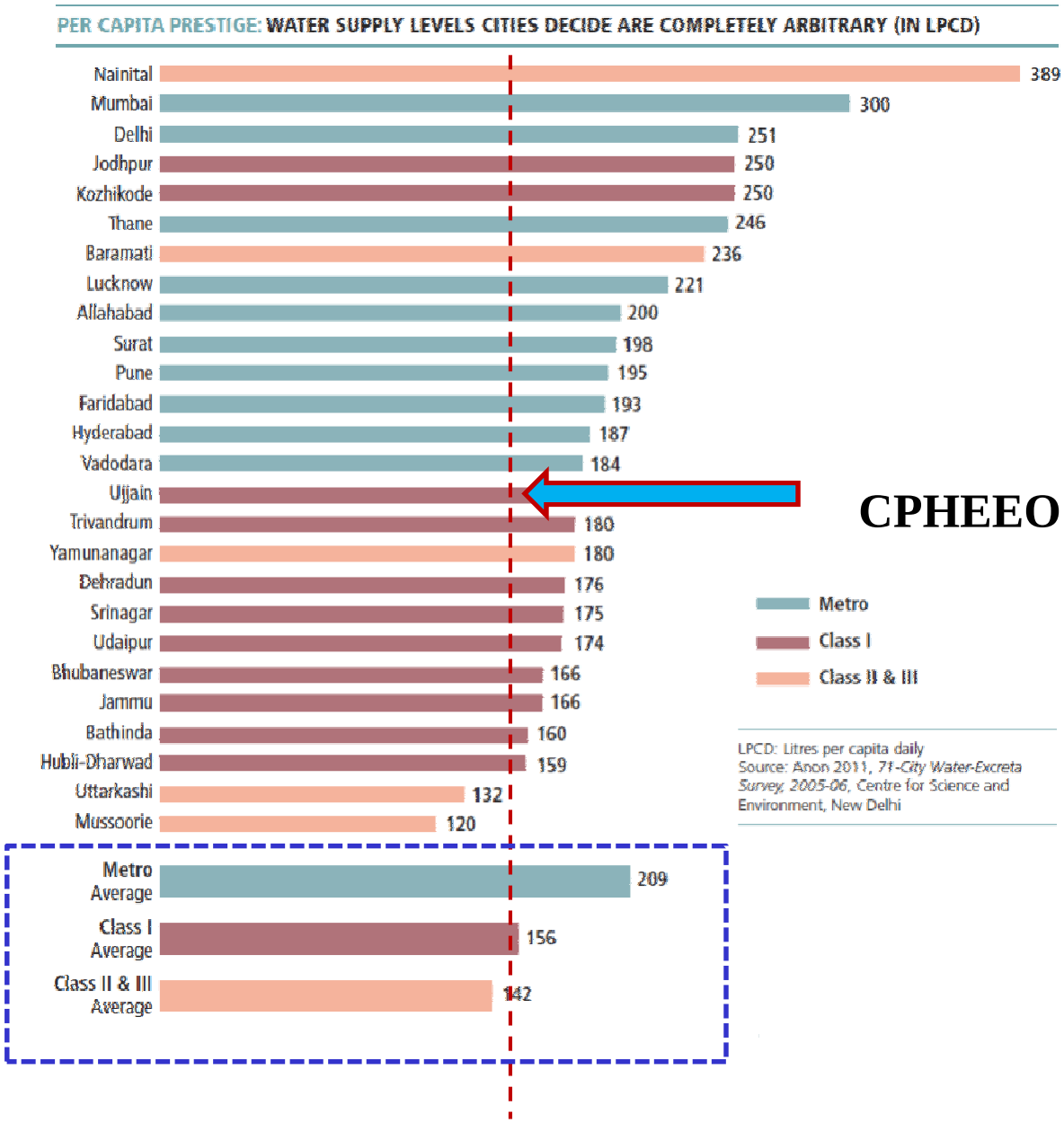

JODHPUR
Indira Gandhi canal
Rajivgandhi lift canal
204 km
N
15
Kanasar
Bap
Dedasri
Jambo
Ghantiyali
Chhayan
Bhojasar
Sirdon
Phalodi
Au
Chadi
Lohawat
Kolu
Paruji
Kapuriya
Rajmalwara
Bhikankor
Bara Bara
Soila
Osiyan
Palri
Asop
Narsar
Ghevra
Kherapa
Bhopalgarn
Salwa
Khurd
Artiya Kalan
Tivari
Manthaniya
Pipar Rd
Khangta
Rathkuriya
Manaklav
Daijar
Sathin
Rian
Pipar
Asranada
Chaba
Shergarh
Agolai
JODHPUR
Binawas
Khejarla
Jhanwar
Kaparda
Kharia
Bhawi
Kakela
Bilara
Mogra
Kankani
Rohicha
Kalan
Luni
Satlana
Dundara

How is urban water supply need is calculated in India ?

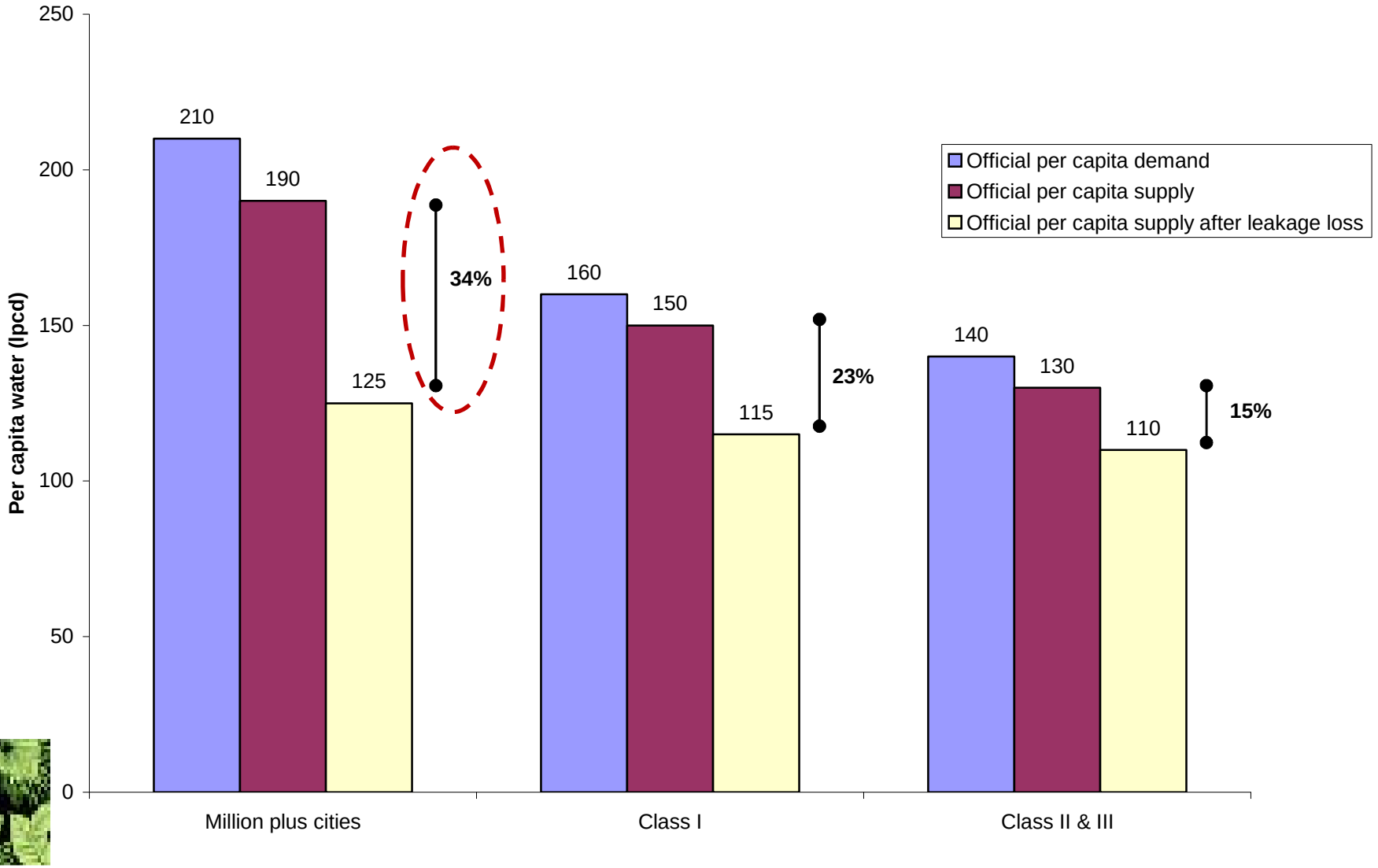
Classification of towns/cities	Recommended maximum water supply levels (lpcd)
Towns provided with piped water supply but without sewerage system	70
Cities provided with piped water supply where sewerage system is exists	135
Metropolitan and Mega cities provided with piped water supply where sewerage systems existing	150

Source: Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation Manual on Water Supply and Treatment, Third Edition -Revised and Updated (May 1999), New Delhi.

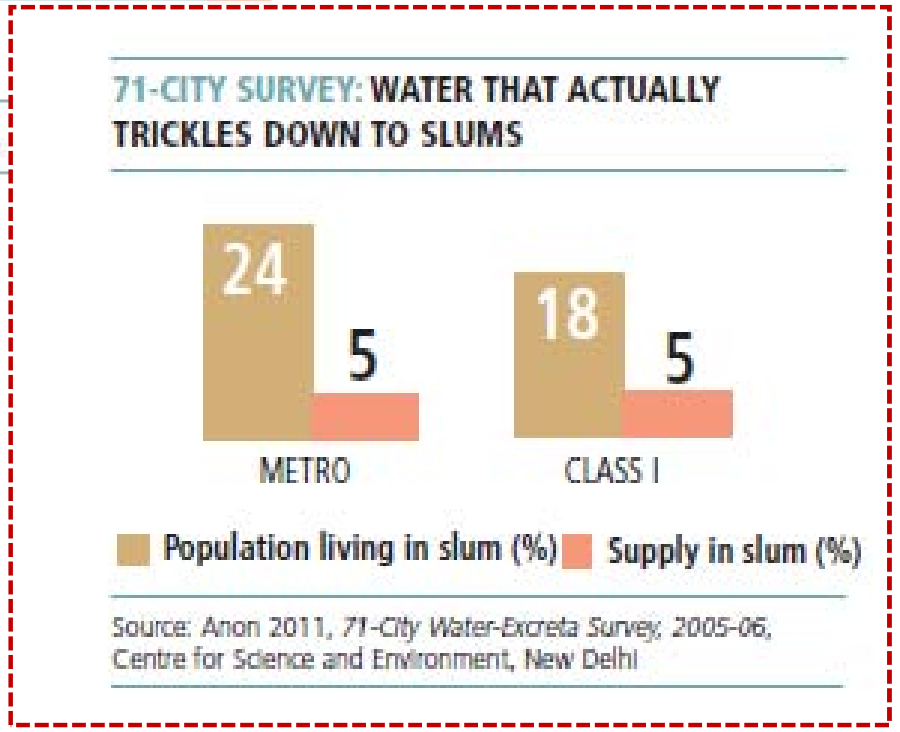
Per capita supply is high and completely arbitrary



Official Water Demand, Supply, leakage loss and supply after loss



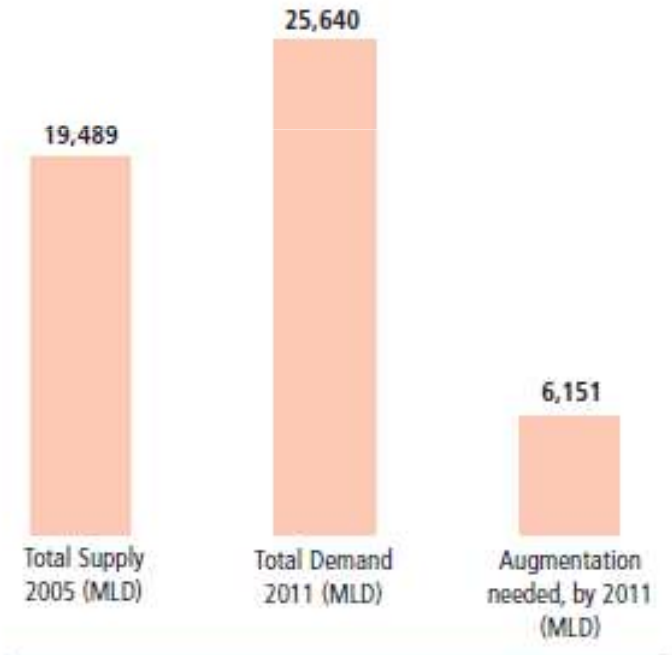
Slums : Unreached, Un-supplied



Cities Craving to Supply More

71 Indian Cities Survey by CSE reveals:

	Supply 2005 (MLD)	Demand 2011 (MLD)	Augmentation needed (MLD)	% Augmentation in 2011
Metro	16,591	21,805	5,214	31
Class I	2,775	3,605	829	30
Class II&III	123	230	107	87



MLD: Million litres daily
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

In 2005

32%

more water was required to meet 2011 water needs

‘Loss’ not just inefficiency

- Distribution loss is **not just** about inefficiency
- Distribution loss **intrinsic to supply system**

  - distance leads to **high transmission losses**
  - distance leads to **high costs of energy**
  - distance leads to **high O&M costs of repair**

But **‘augmentation’** is name of water supply

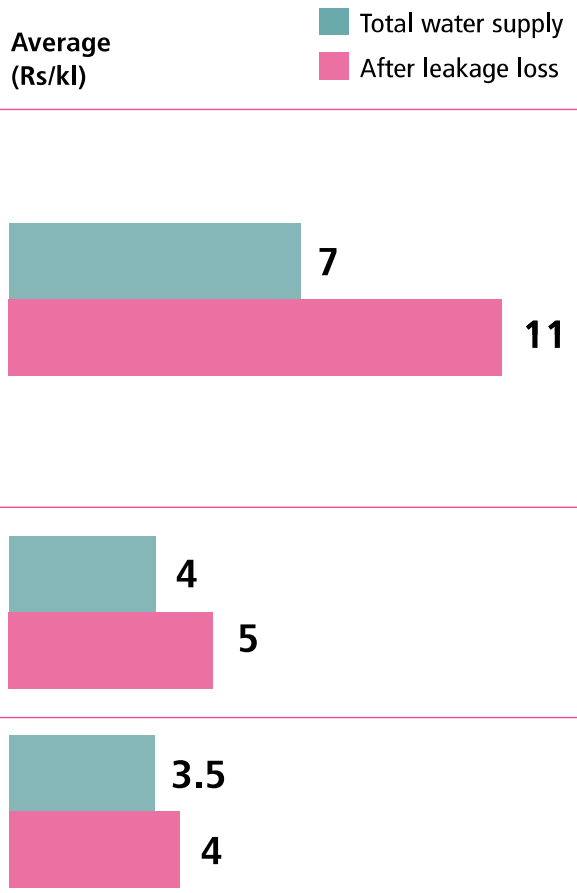
Build, pipe, pump and do not worry about supply

Water highway: **losses, costs**

- Every city reports 30-50% water lost in distribution. **Adds** to cost

71-CITY SURVEY: IF ONLY THE LEAKAGES COULD BE PLUGGED

		Cost of total water supply (Rs/kl)	Cost after leakage loss (Rs/kl)
Metros	Bengaluru	13	21
	Chennai	12	17
	Indore	11	17
	Mumbai	11	15
	Delhi	9	18
	Dhanbad	9	11
	Hyderabad	6	11
	Jaipur	6	11
	Rajkot	6	8
	Vadodara	6	9
	Meerut	0.8	1
Class I	Aizwal	54	83
	Khanna	14	18
	Alwar	9	12
	Jodhpur	9	11
	Kozhikode	8	12
Class II & III	Nainital	17	20
	Mussoorie	17	24
	Raman	2	3
	Uttarkashi	2	3
	Goniana	2	2



kl: kilolitre;
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

City	Water Production cost Rs/kl	Water charges Rs/kl
Delhi	8.95	2.00
Mumbai	5.74	2.25
Jodhpur	20.00	1.21
Indore	9.50	2.00
Bangalore	13.00	5.60

The current paradigm – water supply

More water supplied = More waste water generated = more costs for treatment = Unsustainable

Water, not supplied

- Water sourced from further and further away, **leads to increasing cost of supply**
- Leads to high distribution losses and **less water to supply at end of pipeline**

- **Less water means more costly water**

Cities not able to recover costs of supply, have no money to invest in sewage

Water = Wastewater

Cities plan for water, forget waste

- 80% water leaves homes as sewage
- More water = more waste
- Cities have **no accounts** for sewage
- Cities have **no clue** how they will convey waste of all, treat it, clean rivers
- **Cities only dream of becoming New York or London**

Urban Sanitation - Rating Card

No.	Category	Description	Points	Cities
1	RED	Cities Needing immediate attention	<33	182
2	BLACK	Needing considerable improvement	34-66	230
3	BLUE	Recovering	67-90	4
4	GREEN	Healthy and Clean Cities	91-100	Nil

Red- **Shimla, Srinagar, Allahabad,**

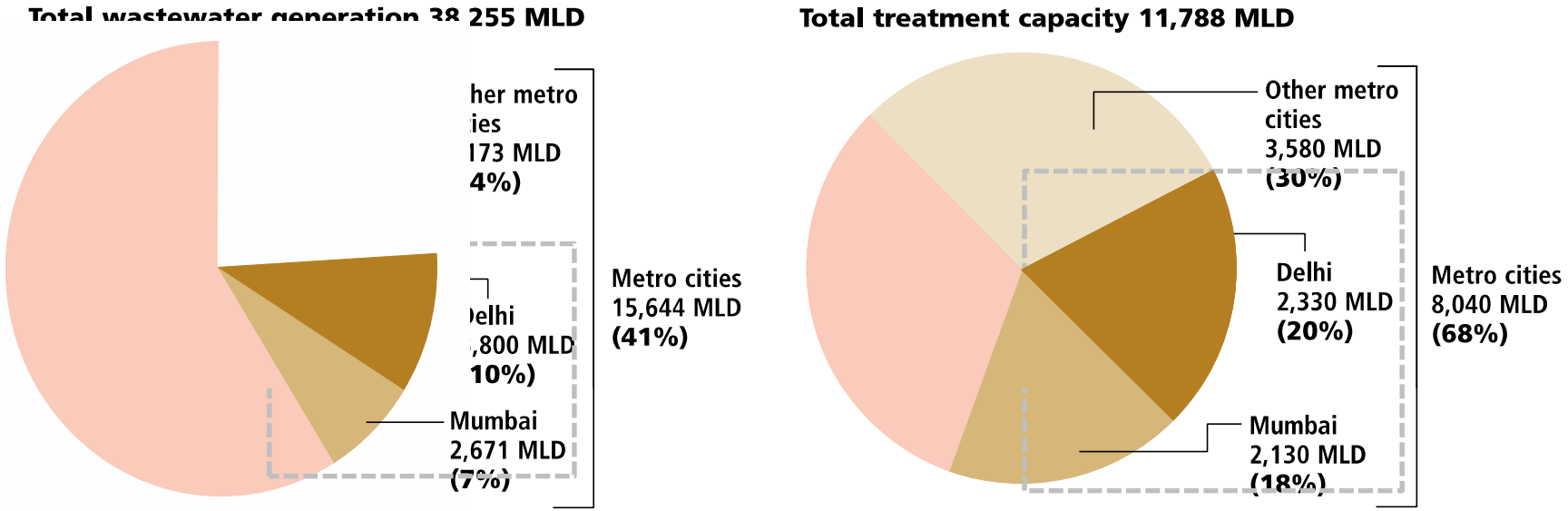
Black- Tiruchirapalli, Jamshedpur, Rajkot, Mangalore, Hyderabad

Blue- Chandigarh, Mysore, Surat, NDMC & Delhi Cantt

Source: Ministry of Urban Development 2010

Sewage : **more** sums

TWO METROS: DISPROPORTIONATE TREATMENT



MLD: Million litres daily
Source: Anon 2009, *Status of Water Supply, Wastewater Generation and Treatment in Class-1 cities and Class-II towns of India*, Central Pollution Control Board, Ministry of Environment and Forests, Delhi

- 30% of total sewage can be treated
- But Delhi and Mumbai alone have **40 per cent** of sewage treatment capacity in the country

Cost Estimates of Select Technologies

Technology	Cost /mld (at 2008 prices) in Rs.lakhs
Waste Stabilization Ponds	25
UASB + Post treatment	55
Activated Sludge Process, C-Tech, FAB	87

- Cost of Interception & Diversion works (main trunk sewers, SPS excl. house connections, branch and lateral sewers) and cost of land acquisition is around Rs. 3-4 crore per mld

- Estimated Class I & II Sewage Generation in year 2020 = 45000 mld

- Cost would increase to the extent of Rs. 45,000 crore to Rs. 1,32,000 crore.

Planning for **hardware**

Cities plan for treatment not ‘sewage’

- Treatment plants are not simple answers
- **Can build plants to treat, but there is no waste being conveyed for treatment**
- Most cities do not have underground sewerage. But engineers sell pipe-dreams of **catching up with infrastructure**
- Politicians buy pipe-dreams
- We lose rivers. Generations of **lost rivers**

71-CITY SURVEY: AREA COVERED BY CLOSED DRAINS SHOWS REAL STATE OF SEWAGE COLLECTION

% of area covered	
0-10	Cuttack, Guwahati, Jabalpur, Jammu, Ranchi, Thane, Aizawl, Bathinda, Bhilwara, Siliguri, Srikakulam
10-30	Agra, Alwar, Aurangabad, Indore, Mathura, Meerut, Puducherry, Thiruvananthapuram, Dehradun, Dewas, Hubli-Dharwad, Jhansi, Kozhikode, Lucknow, Solapur, Tumkur, Udaipur, Ujjain, Dhanbad
30-50	Allahabad, Bengaluru, Bhopal, Delhi, Lucknow, Patna, Srinagar, Amritsar, Bhubaneswar, Jodhpur, Mumbai
50-70	Faridabad[2], Hyderabad, Jaipur[1], Kanpur, Kolkata, Nagpur, Gwalior, Mussoorie, Nainital, Rajkot, Vadodara, Yamunanagar
> 70	Chennai, Pune, Surat, Gurgaon[2]

[1]Claims 80% coverage in CSE survey, 65% in City Development Plan for JNNURM; [2]Faridabad and Gurgaon: only old-city within municipal limit included
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

<10

Guwahati, Jabalpur, Jammu, Ranchi, Thane, Aizawl, Bathinda, Bhilwara, Jammu, Jabalpur, Siliguri, Srikakulam

- **Cities do not have drains**
- **New growth cities are growing without drains**
- **Backlog and front-log impossible to fix**
- **As cities fix one drain, another goes under**

For example - Bengaluru: **sewage not reaching**

- 3610 km of sewage pipes
- **14 sewage treatment plants = 781 mld**
- Generates 800-1000 mld of sewage
- **But treats only 300 mld**
- Rest does not reach
- Now plans to build 4000 km more
- **Builds, grows and more lines need repair**
- **Catch-up that does not catch-up**

Partial treatment = pollution

“Cities do not control pollution” and Cost of building system is high

- City can build sewerage system for **few** not all
- Spends on building pipes, repair and energy costs of pumping to treatment plant of this waste of some **few**
- Spends to treat waste of some **few**
- Treated waste of **few** gets mixed with **untreated waste of majority**
- The result **is pollution**

For example : Delhi

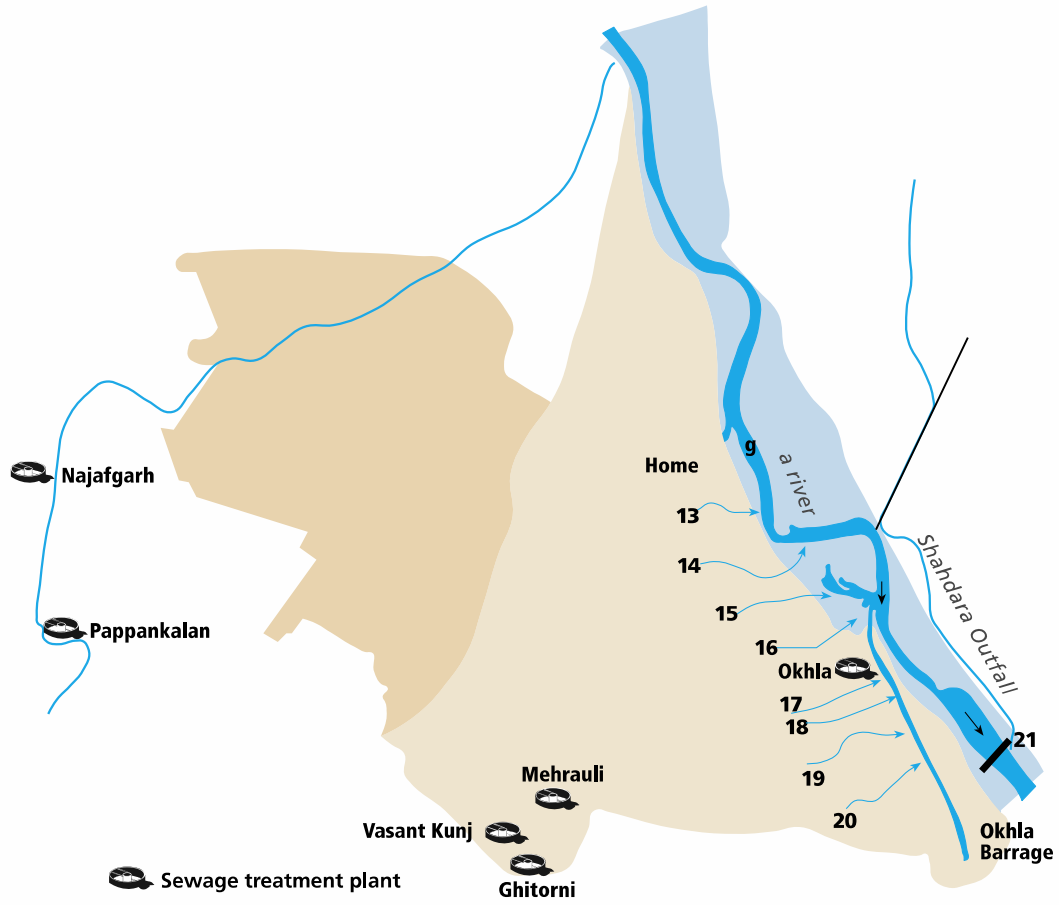
Has 20 drains
Has 17 STP

Capacity exists
But River Yamuna dead

Why?
Delhi keeps building to ‘catch up’

Can’t
Sewage reaches river

MERRY-GO-ROUND III: DELHI’S ATTEMPT TO CLEAN THE YAMUNA IS THE MYTH OF SISYPHUS ACTUALISED



Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

River has no water only sewage

For example : Chennai

Funds spent

Sewage system coverage high
Large number of pumping stations

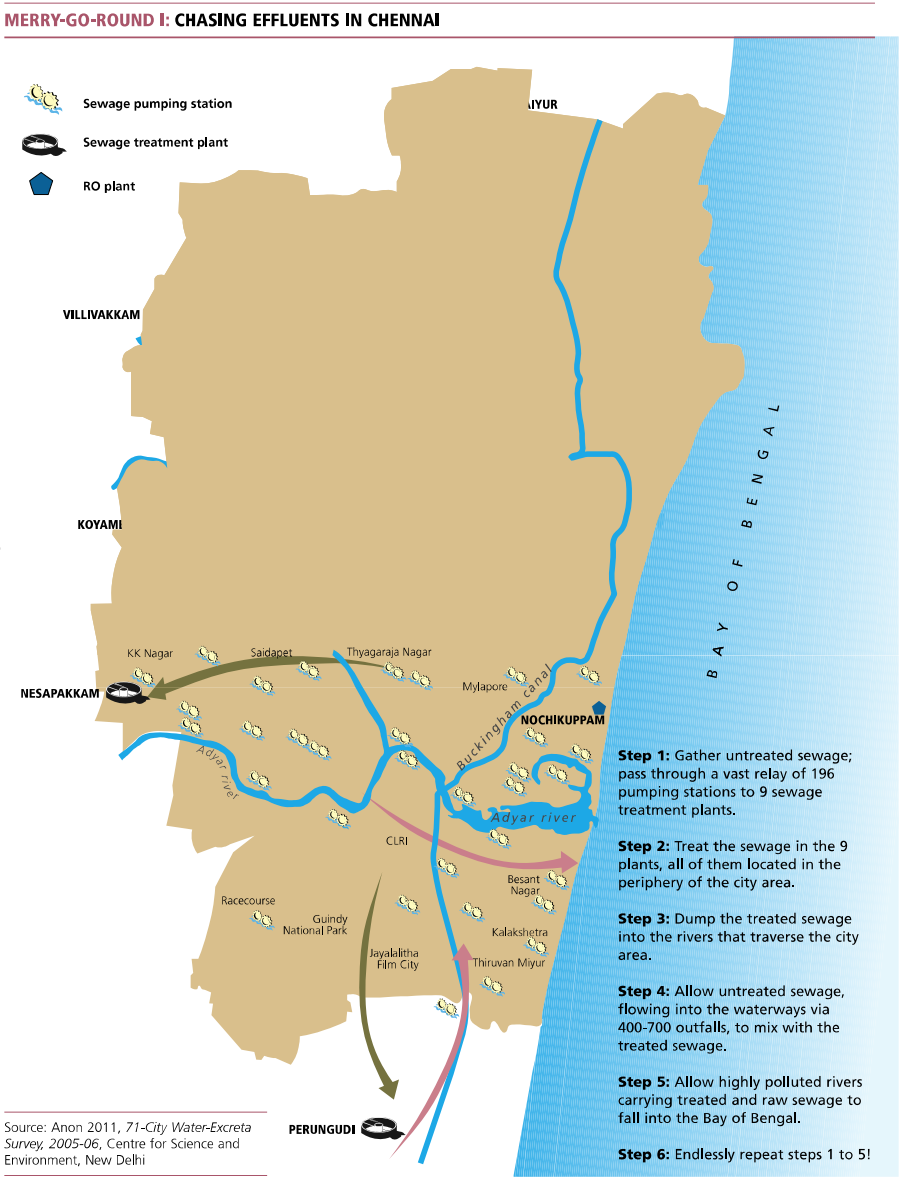
Why still polluted?

Pumps and pumps
Takes to outskirts of city
Dumps it back into canals and rivers
These flow through city

Engineers say ‘all is well’
Waste is intercepted
Only stormwater flows

But not true

Sewage flows ,
Treated sewage flows



Urban water paradigm – cause & effect

Supply

Water is imported – pipes, tankers, trains

↓

Costs for government

↓

Cannot meet the demand

↓

Indiscriminate groundwater mining within and outside the city

Treatment

Raw water quality is very poor

↓

Costs of treatment for government

↓

Cannot meet the demand

↓

High health impacts among poor

Growth of bottled water industry

Sewerage

Supplied water turned into polluted water

↓

Costs of collection and treatment for government

↓

Cannot meet the demand

↓

Polluted rivers and lakes. Further reduction of water supply

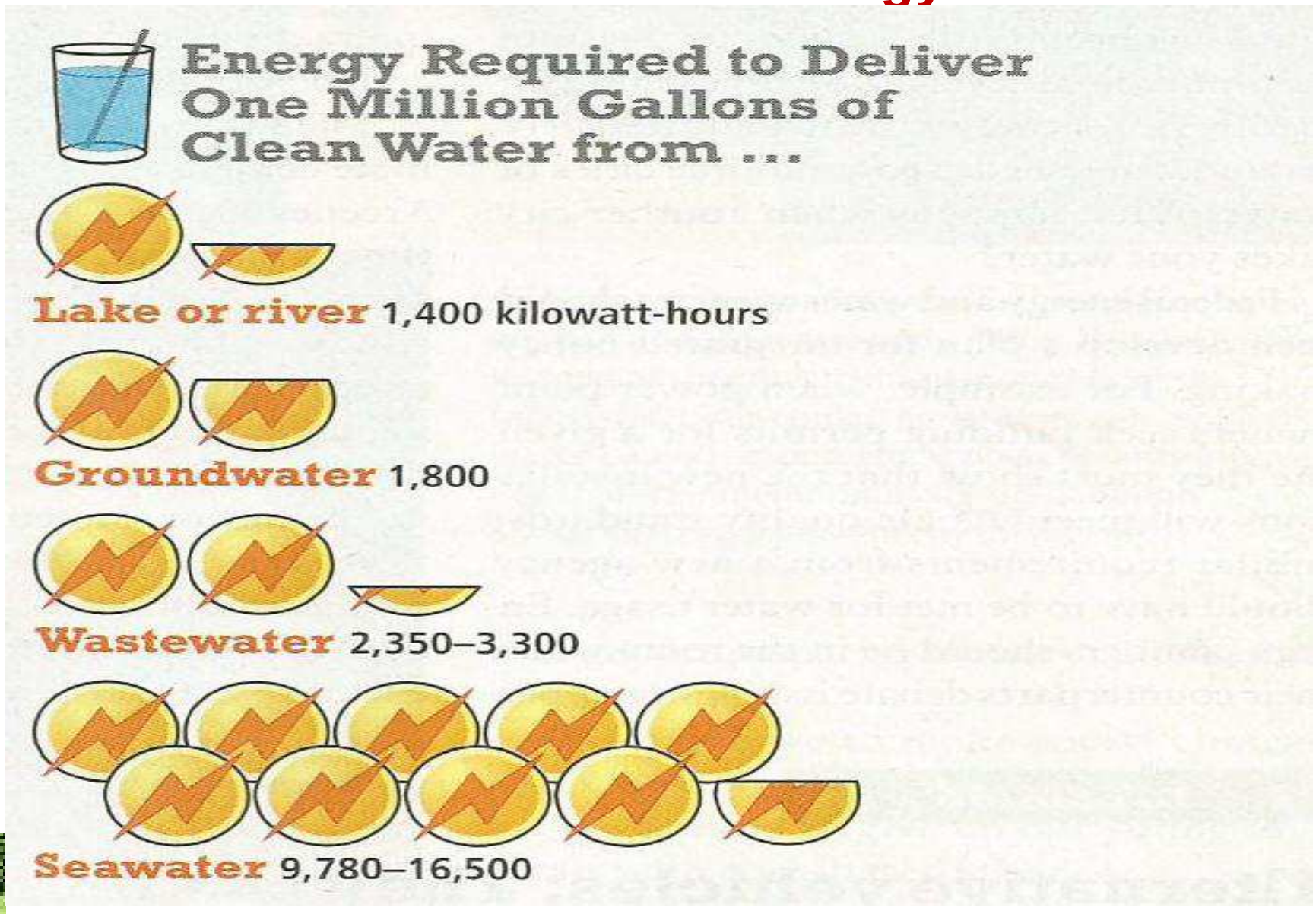
Electricity Tariff Hike

State	Hike (%) Since January 2012
Tamil Nadu	37
Andhra Pradesh	37
Haryana	31
Kerala	30
Mumbai	28
Kolkata	24
Punjab	21
Rajasthan	19

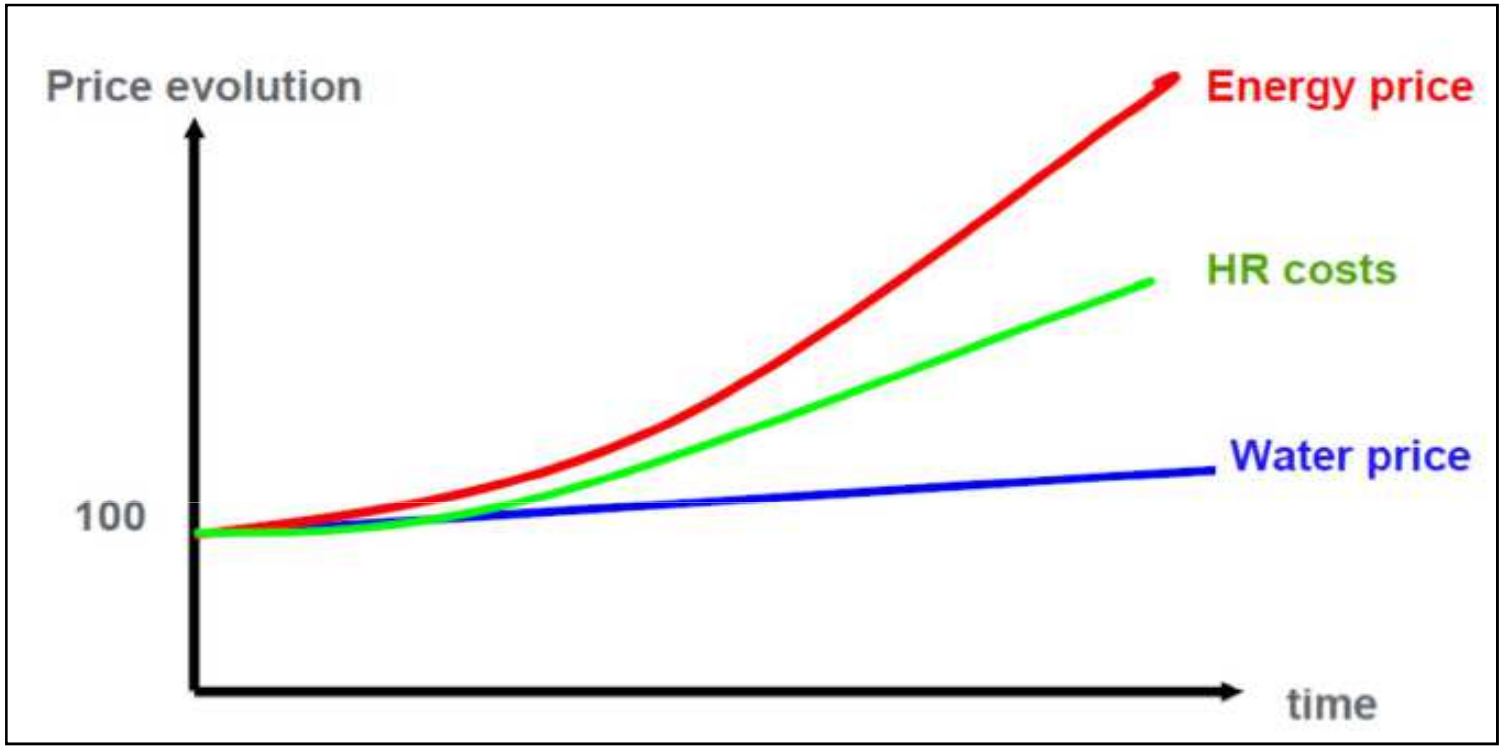
Source: BSES, 2013

- **31 States & UTs have raised their tariff in 2012 – many have raised even twice in the year.**
- **30-50 % of ULBs revenue spent towards electricity for municipal water / wastewater management.**

Water Production & Energy Use



Water financials, a dilemna



- Water price is a public issue (no volatility, even fixed)
- Chemicals & additives will increase
- Asset management need regular investments

Source: Schneider Electric

Cannot play catch up game

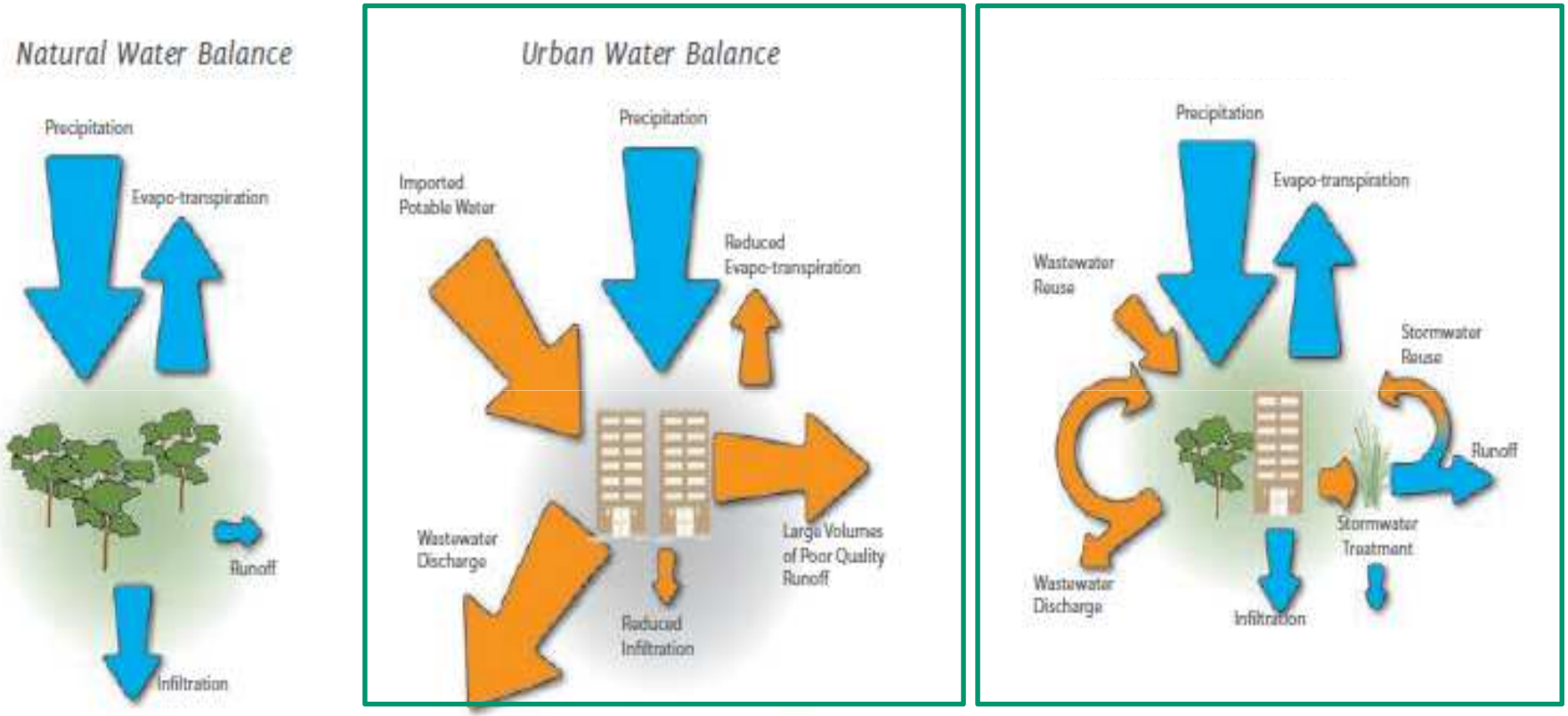
Cannot flush – and forget

Have to find new approaches :

affordable and sustainable

Rework water-energy nexus in UWM; rework economics

- Need to fix urban water use. Cannot be wasteful any more.
- Reduce energy to cut costs; Need to charge to reduce wastage
- Local recycle and reuse waste water
- **Closing the loop!**



New Paradigm

Today's Sustainable Urban Water Management - Agenda

Challenge of innovative policy and practice

Challenge of scale -- implement change at the scale of the transition needed

Challenge of capacity – need multipliers in society to implement changes, think and act differently

Reform Agenda:

Today **idea** is accepted but **practice** is not

Practice difficult

Practices, methods evolved in the rich world are
unaffordable or unworkable

Practice does not push envelope of change

At ULB level need big-ticket change

Paradigm Shift in Enabling Environment

Mainstreaming requires paradigm shift at all four levels – in terms of development in practice:

Policy → Plan → Programme

&

Project

In DPRs for JnNURM Phase II :

We need objectives, indicators and standards that can be measured and monitored and that meet challenges of 'energy efficiency aimed at carbon neutral city'.

JnNURM Phase II -

Steps towards doing things effectively and efficiently

Effective: Doing right things ? **Important**

EFFICIENCY: Doings things right ? **Urgent**

Future Urban Hydrology

- **Capturing rainwater from macro and micro catchments**
- Rooftop water harvesting and groundwater recharge

and also –

- Recycle wastewater
- Look at dry sanitation options
- Use less water. Do not be wasteful - Do not make cities first water-wasteful and then think efficiency.
- **Only bring the deficit water from outside**.

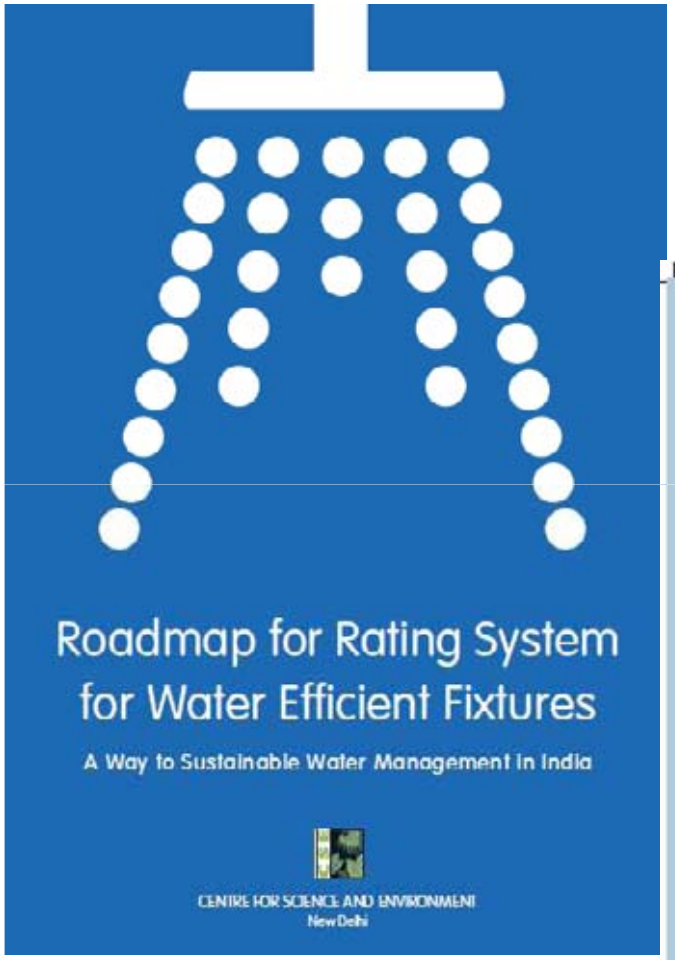
Future Urban Hydrology

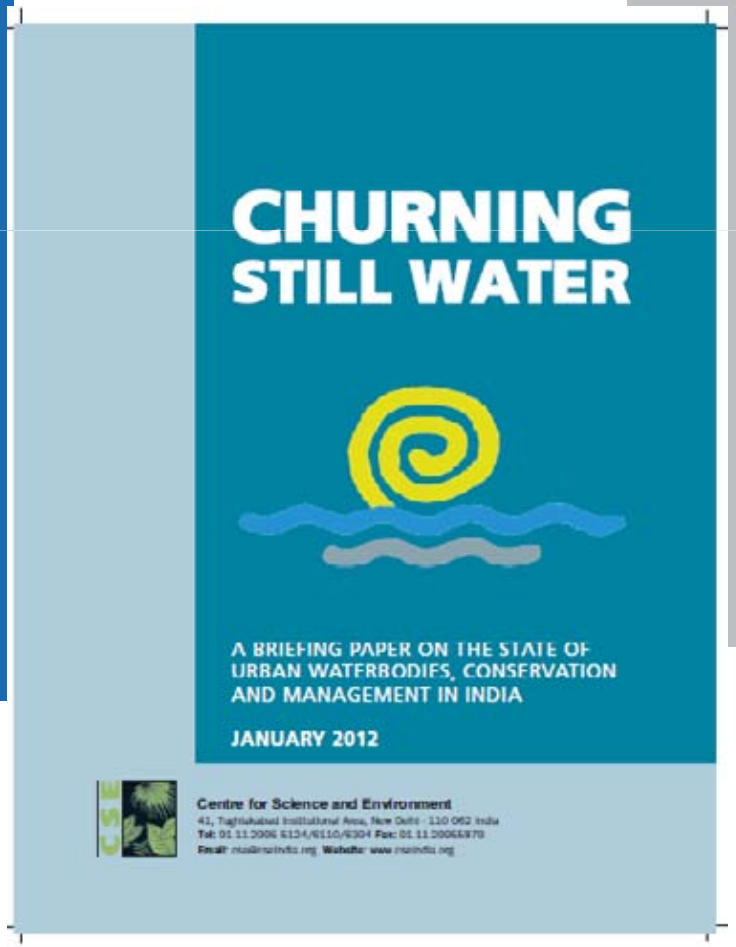
- Not a task for engineers alone
- Integrated planning of urban land and water
- Objective of equity, economic efficiency and environmental integrity
- Making water everybody's business…

Way ahead

- Create **informed public opinion**
- **Demand side** management
- **Capacity building & training** the real users and implementers
- **Legislation** followed by strict implementation

Policy Papers and Roadmap for mainstreaming Resources & Energy Efficiency





THANK YOU