

## **Design Period**

- Usually taken as 30 years after completion of the project
  - 50 years for certain components and 15 years for certain other components
  - Time lag between design and completion of project can be 2 to 5 years
- Future expansion and duplication provisions can be incorporated into the project
- Water supply should match with water demand at the end of design period
  - Water requirements at the end of the design period should be known
  - Requires population and its spatial distribution at the end of the design period.
- Commercial, institutional and industrial development patterns of the city should be known
- Life styles and Improvements in living standards affect the water demands
- Water conservation measures (source minimization and recycling and reuse of treated effluents) minimize water demands

# **Water demands of urban population**

- **Industrial water demands (including animal keeping)**
  - Number, type and size of industries and their water intensities
- **Public and ecological water demands**
  - Public taps
  - Public urinals and community toilets
  - Swimming pools and community baths
  - Street washing/wetting
  - Sewer flushing
  - Irrigation of public parks and gardens
  - Public fountains
- **Fire water**
- **Unaccounted for water**
  - Leaks
  - Wastage of water
  - Unauthorized and illegal connections

## **Factors affecting per capita water demands**

- **Size of the city:**
  - Demand increases with size
  - Fluctuations in demand are larger with lower population size
- **Climate conditions (temperature, precipitation, wind) and season**
  - Water demands peak during summer months
  - Fire demands are higher in summers (hourly demands increase)
- **Commercial, institutional and industrial development and activities**
- **Population density and urban landscaping: Public and ecological uses of water are influenced.**
- **Housing: Slums, independent houses and multistoried buildings; Ground floor dwellings or dwellings in the other floors; Per capita floor area and plot area.**
- **Income groups (low, middle and high income groups, and EWS) and Standard of living**
  - High income households consume 250-400 LPCD
  - For EWS (economically weaker sections) 135 LPCD requirement
  - Some households consume as low as 40 LPCD water

# Water Demand

- **Designed capacity of the water supply system (WSS)**
  - Meeting water demands at the end of the design period
  - Design period: service life of different components of a water supply system (varies from 15 years to 100 years)
- **Water demands at the end of the design periods are basis for the water supply systems design**
  - Water demands at each of the supply nodes may be needed
- **Average Day Demand (ADD); Maximum Day Demand (MDD); and Peak Hour Demand (PHD) are actually required**
  - ADD is annual water consumption divided by 365 days
  - MDD is taken as 1.8 times the ADD
  - PHD is taken as  $(1.5/24)$  MDD (distribution pumps, reservoirs and system are designed for the PHD)
- **Water demand = (Per capita demand)<sub>EDP</sub> x (Population)<sub>EDP</sub>**
- **Using urban population history, (Population)<sub>EDP</sub> is forecasted**

# **Water demands of urban population**

- **Residential water demands**
  - Indoor uses: Toilet flushing, Bathing, Washing clothes, Kitchens (cooking and drinking), Wash basins (miscellaneous washing), Desert coolers and Miscellaneous (house cleaning!) uses.
  - Outdoor uses: Kitchen gardening and irrigation of lawns and hedges; Car wash and vehicle cleaning; Yard/road wetting, etc.
- **Commercial and institutional water demands**
  - Shops, malls and markets
  - Food joints, restaurants and hotels
  - Clinics, nursing homes, health centers and hospitals
  - Cinema houses, concert halls and theaters
  - Temples and other religious places
  - Schools, colleges, institutions and universities
  - Offices and administrative buildings
  - Railway stations, bus stations, air ports and sea ports

<b>For cities/towns with population &lt;1,00,000</b>	<b>3600 L/min/50,000 population for 2 hr duration</b>
<b>For cities with population 1,00,000 to 3,00,000</b>	<b>1800 L/min./50,000 population for 2 hr duration</b>
<b>For cities with population &gt;3,00,000</b>	<b>1800 L/min./1,00,000 population for 2 hr duration</b>

**Sufficient fire water should be available within 1 Km<sup>2</sup> area.**

**For civil defense towns/cities the fire water requirements are doubled.**

**High rise buildings areas should have at least one fire water tank of 220 m<sup>3</sup> capacity in every 1 km<sup>2</sup> area.**

## Other water requirements (IS 1172?)

Public use demand: 5% of the total consumption

Public parks: 1.4L/m<sup>2</sup>./day

Street washing/wetting): 1.0 to 1.5 L/m<sup>2</sup>/day

Sewer cleaning: 4.5 LPCD

Industrial water demand: 20-25% of the total city water demand

Allowances for leaks, wastes and thefts: 15%

### Average Indian town water demands

Domestic:	<b>135 LPCD – 50% (65-300: 160 – 35%)</b>
Commercial, institutional and industrial:	<b>40 LPCD – 15% (45-450: 135 – 30%)</b>
Public use:	<b>25 LPCD – 9% (20-90: 45 – 10%)</b>
Fire demand:	<b>15 LPCD – 6% (fire + public use)</b>
Losses, Wastage and thefts:	<b>55 LPCD – 20% (45-150: 62 – 25%)</b>
Total:	<b>270 LPCD (402 LPCD)</b>

## **Per capita water demand**

- **Diverse urban water demands need expression as per capita water demands**
  - Residential, commercial, institutional, industrial, public & ecological, and fire water (and unaccounted for water!)
- **Assorting the water demands between the dual water supply systems may also be needed**
  - Virgin water supply systems
  - Reclaimed and local water supply systems
- **Per capita water demand is dynamic and changing**
  - Currently increasing but may show a decreasing trend in future
- **Per capita demand varies widely among the urban population, and average per capita demand must be considered**
- **Water demands are also influenced by**
  - Water availability and supplies
  - Water costs and water charging
  - Water conservation measures



<b>1.</b>	<b>For communities of &lt;20,000 population</b>	
	<b>Water supply through stand posts</b>	<b>40 LPCD</b>
	<b>Water supply through house service connections</b>	<b>70 LPCD</b>
<b>2.</b>	<b>For communities with 20,000 to 1,00,000 population (with full flushing system)</b>	<b>100 to 150 LPCD</b>
<b>3.</b>	<b>For communities with &gt;1,00,000 population (with full flushing system)</b>	<b>150 to 200 LPCD</b>

**Of the 150-200 LPCD 45 LPCD is meant for toilet flushing**

**For LIG (low income group) and EWS (economically weaker section) housing water requirements are reduced to 135 LPCD**

<b>1.</b>	<b>Factories with bath room facilities</b>	<b>45 LPCD</b>
	Factories with no bathroom facilities	30 LPCD
<b>2.</b>	<b>Hospitals with &lt;100 beds (including laundry facilities)</b>	<b>340 LPCD</b>
	Hospitals with >100 beds (including laundry facilities)	450 LPCD
	Nurses' homes and medical quarters	135 LPCD
<b>3.</b>	<b>Hostels</b>	<b>135 LPCD</b>
	Hotels	180 LPCD
	Restaurants	70/seat
<b>4.</b>	<b>Offices</b>	<b>45 LPCD</b>
<b>5.</b>	<b>Cinema houses, concert halls and theaters</b>	<b>15/seat</b>
<b>6.</b>	<b>Day schools</b>	<b>45 LPCD</b>
<b>7.</b>	<b>Boarding schools</b>	<b>135 LPCD</b>
<b>8.</b>	<b>Railway (no express/mail stops), bus stations and sea ports*</b>	<b>45/25# LPCD</b>
	Junction railway stations & stations with express/mail stops*	70/45# LPCD
	Terminal stations*	45/45# LPCD
<b>9.</b>	<b>Air ports (international and domestic)*</b>	<b>70/70# LPCD</b>

## **Factors affecting per capita water demands**

- **Social and cultural conditions and life styles: Habits, social status, and customs of people**
- **Time of the day and day of the week**
  - Normal days, weekend days, and festive days or special days
  - Most of the day's water is consumed between 6 – 10 AM and between 4 – 8 PM (demand for the rest 16 hrs is negligible)
- **Quality, quantity and availability of water**
  - Reliability of water supply
  - Water supply patterns (continuous and intermittent supplies)
  - Water pressure in the water distribution system (Increasing pressure increases wastage and leaks)
  - Water metering and charging
- **Water conservation measures**
  - Use of water efficient taps, showers, washing machines, toilet flushes, garden hoses, etc.