MEETING THE CHALLENGES IN WATER AND SANITATION
THE CHENNAI EXPERIENCE
STRUCTURE OF THE PRESENTATION

- General
- Water Supply Management
- Water Conservation Measures
- Sewerage Services Management
- PPP Initiatives
Chennai, the capital of Tamil Nadu, is the fourth largest city in India.

The growth of the City started in 17\textsuperscript{th} Century.

Organized water supply commenced in 1872 & protected water supply in 1914

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Geographical Area</td>
<td>426 Sq.Km</td>
</tr>
<tr>
<td>3. Topography</td>
<td>Flat</td>
</tr>
<tr>
<td>4. Drainage</td>
<td>Adayar &amp; Cooum Rivers</td>
</tr>
<tr>
<td>5. Average Rain fall</td>
<td>1100 mm to 1300 mm per year</td>
</tr>
<tr>
<td>6. Temperature</td>
<td>30(^\circ) c to 40(^\circ) c</td>
</tr>
<tr>
<td>7. Water Supply Sources</td>
<td>Surface and ground water</td>
</tr>
<tr>
<td>8. Present Supply Level</td>
<td>831 Mld (City 766 mld + Others 65 mld)</td>
</tr>
<tr>
<td>9. Current Supply Rate</td>
<td>Erstwhile Chennai City 145 lpcd + Added areas 40 lpcd</td>
</tr>
</tbody>
</table>
## Constitution of The Board

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hon’ble MINISTER MUNICIPAL ADMINISTRATION &amp; RURAL DEVELOPMENT</td>
<td>CHAIRMAN &amp; EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>2.</td>
<td>PRINCIPAL SECRETARY MUNICIPAL ADMINISTRATION &amp; WATER SUPPLY DEPARTMENT</td>
<td>EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>3.</td>
<td>PRINCIPAL SECRETARY FINANCE DEPT</td>
<td>EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>4.</td>
<td>MANAGING DIRECTOR TWAD BOARD</td>
<td>EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>5.</td>
<td>MEMBER SECRETARY CMDA</td>
<td>EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>6.</td>
<td>COMMISSIONER CORPORATION OF CHENNAI</td>
<td>EX-OFFICIO DIRECTOR</td>
</tr>
<tr>
<td>7.</td>
<td>MANAGING DIRECTOR CMWSS BOARD</td>
<td>FULL TIME DIRECTOR</td>
</tr>
<tr>
<td>8.</td>
<td>EXECUTIVE DIRECTOR CMWSS BOARD</td>
<td>FULL TIME DIRECTOR</td>
</tr>
<tr>
<td>9.</td>
<td>FINANCE DIRECTOR CMWSS BOARD</td>
<td>FULL TIME DIRECTOR</td>
</tr>
<tr>
<td>10.</td>
<td>ENGINEERING DIRECTOR CMWSS BOARD</td>
<td>FULL TIME DIRECTOR</td>
</tr>
</tbody>
</table>
Water supply Management
New Veeranam 180 mld pipe line alignment

100 mld Desalination Plant at Nemmeli under trial run

100 mld Desalination Plant at Minjur

Capacity 3231 mcft

Capacity 3645 mcft

Capacity 881 mcft

Capacity 3300 mcft

POONDI RESERVOIR

POONDI WELL FIELD

TAMARAPAKKAM WELL FIELD

POONDI RESERVOIR

FLOOD PLAINS WELL FIELDS

KANNIGAIPER WELL FIELD

MINJUR WELL FEILD

CHENNAI METROPOLITAN FLOOD PLAINS

TAMARAPAKKAM

WELL FEILD

POONDI RESERVOIR

SRIPERUMPUDUR TANK

CHEMBARAMBakkAM TANK

PORUR LAKE

REDHILLS RESERVOIR

530 mld Plant

BAY OF BENGAL

100 mld Desalination Plant at Minjur

100 mld Desalination Plant at Nemmeli under trial run

Source Map (Water)
Chennai City Water Supply – Sources & Storage
Total Storage Capacity 11.057 TMC

Poondi – 3.231 TMC
Cholavaram – 0.881 TMC
Red Hills -3.300 TMC

Chembarambakkam – 3.645 TMC
Veeranam -1.465 TMC
Desalination Sources – Total Capacity 200 MLD

Desal Plant Minjur – 100 MLD (Commissioned on 30.10.2010)

Desal Plant Nemmeli - 100 MLD (under trail run)
Water Treatment Plants
Total Capacity 1494 MLD (Million Litres per Day)

Kilpauk – 270 MLD  
Red Hills – 300 MLD  
Vadakuthu – 180 MLD

Chembarambakkam -530 MLD  
Surapet – 14 MLD  
Desal Plants – 100 MLD + 100 MLD (under trail run)
Water Supply Systems

Sources / Reservoirs (5) & Desalination Plants (2)

831 MLD is supplied

Water Treatment Plants (5) – 1494 MLD
(100 MLD Desalination Plant at Nemmeli will be commissioned Feb 2013)

Water Distribution Stations
(Head Works) – (16)

4444 kms
Distribution Network (2930 Kms) & Networks in added areas (1514)

House Service Connections (4,93,903)
Erstwhile City (3,96,483) + Added Area (97,420)

Consumers (7,29,389)
Erstwhile City (5,95,600) + Added Areas (1,33,789)
### Daily Distribution of water to Chennai City

<table>
<thead>
<tr>
<th>Pipeline / Lorry supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. City</td>
<td>686 MLD</td>
</tr>
<tr>
<td>2. Added Areas</td>
<td>80 MLD</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td><strong>766 MLD</strong></td>
</tr>
<tr>
<td>Industrial Supply through pipeline</td>
<td>37 MLD</td>
</tr>
<tr>
<td>Bulk Supply through pipeline</td>
<td>28 MLD</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>831 MLD</strong></td>
</tr>
</tbody>
</table>

**PRESENT POPULATION/DEMAND/SUPPLY/GAP**

- Demand For the present 6.73 Million Population = **1009 MLD**
- Present supply = **831 MLD**
- Gap = **178 MLD** (100 MLD desal under trial run)

**FUTURE POPULATION DEMAND – 2031** = **1447 MLD** (Addl.Desal Plants – 400 MLD + 300 mld additional realization from Krishna water)

**FUTURE POPULATION DEMAND – 2041** = **1783 MLD** (Kaveri water – 900 MLD)
### Challenges in Water Supply

<table>
<thead>
<tr>
<th>Problems</th>
<th>Solutions</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Storage capacity of Reservoirs (only 12 TMC – we need 15 TMC)</td>
<td>New Reservoirs (3 TMC to be created and also Desalination Project)</td>
<td>Action by PWD</td>
</tr>
<tr>
<td>Low Water Treatment capacity to meet future demand</td>
<td>New Treatment Plants (at least 2) necessary,</td>
<td>To be taken up on confirmation of sources/allocation</td>
</tr>
<tr>
<td>Inadequate water carrying capacity from WTP to WDS</td>
<td>New lines between 530 MLD Water Treatment Plant and Water Distribution Stations.</td>
<td>Approval accorded and works to be taken up.</td>
</tr>
<tr>
<td>Inequitable distribution of water in the city (50 lpcd to 250 lpcd)</td>
<td>Pressure control valves and zoning methods necessary to maintain equal pressures</td>
<td>Being done</td>
</tr>
<tr>
<td>Frequent Leaks and Bursts due to very old pipes and encrusted pipes</td>
<td>Replacement of pipes (DI) in phased manner.</td>
<td>Permanent rectification works are being taken up periodically.</td>
</tr>
<tr>
<td>Low carrying capacity of pipes in distribution systems</td>
<td>Enlargement of pipes would ensure a flow and quantity.</td>
<td>Approved. Works already taken up (JnNURM/ Chennai Mega City Development Mission).</td>
</tr>
<tr>
<td>Non Revenue Water (NRW) / Unaccounted for water (UAW)</td>
<td>Volumetric Billing (Metering) &amp; Enforcement</td>
<td>Works being carried out.</td>
</tr>
</tbody>
</table>
Challenges to meet additional water requirement - Added Local Body areas

- 42 Adjacent Local Bodies to be included within the Chennai City
- Present Per Capita supply is about 40 lpcd against the norm of 150 lpcd
- The total requirement for these added areas is 400 MLD
- Desalination is the option to meet the additional requirement. Consultants in place for DPR.
- To meet the future demand for the year 2041 new water source (Kaveri) to yield 15 TMC is planned (Feasibility study is in progress).
WATER CONSERVATION MEASURES

- Construction of Check dams
- Leak Detection and Rectification works
- Reuse of Waste water for Industrial use
- Rain water Harvesting
Sewerage Management
Sewerage Systems

Sewage generation per day (580 MLD)

Connections (4,45,260)
Erstwhile City (3,67,297) + Added Area (77,693)

Length of Sewer main (4265 kms)
Erstwhile City (2875 kms) + Added Area (1390 kms)

No. of Pumping stations (218)
Erstwhile City (198 nos) + Added Area (20 nos)

No. of Treatment Plants (10)
(Treatment capacity available 558 mld)

Water ways / End Product
(35 MLD Secondary Treated sewage given to Industries
516 MLD let into City Water ways
after secondary treatment)
Sewerage system in Chennai city

**Legend**

1. KODUNGAIYUR
2. KOYAMBEDU
3. NESAPAKKAM
4. PERUNGGUDI
5. VILLIVAKKAM

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of consumers</td>
<td>6,10,318</td>
</tr>
<tr>
<td>Length of sewer mains</td>
<td>4,266 Kms</td>
</tr>
<tr>
<td>No. of Pumping Stations</td>
<td>218</td>
</tr>
<tr>
<td>Treatment Plants</td>
<td>10 Nos.</td>
</tr>
<tr>
<td>Existing Sewage Treatment Capacity</td>
<td>558 mld</td>
</tr>
<tr>
<td>Sewage Treatment Plant (under construction)</td>
<td>264 mld</td>
</tr>
<tr>
<td>Sewage Treatment Plant (Proposed)</td>
<td>220 mld</td>
</tr>
</tbody>
</table>
Sewerage Treatment Plants

Koyambedu

Treatment Capacity = 94 MLD

Nesapakkam

Treatment Capacity = 63 MLD

Perungudi

Treatment Capacity = 54 MLD

Kodungaiyur

Treatment Capacity = 270 MLD
Sewerage Treatment Plants - Power Production from Bio-gas

Bio-Scrubber

Gas Engine
### Challenges in Sewerage Services

<table>
<thead>
<tr>
<th>Problems</th>
<th>Solutions</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate / Sewage Pumping mains</td>
<td>Lines between pumping stations and STPs to be laid.</td>
<td>Improvement works being carried out periodically.</td>
</tr>
<tr>
<td>Inadequate sewage Treatment capacity</td>
<td>Additional STPs necessary at the right places</td>
<td>Under Progress – 264 MLD Proposed – 220 MLD</td>
</tr>
<tr>
<td>Frequent leaks and Bursts of pipe lines</td>
<td>Enlargement of Pipes / replacement of old pipes</td>
<td>Improvement works being carried out periodically.</td>
</tr>
<tr>
<td>Frequent Blocks and overflows through manholes</td>
<td>Maintenance Issues (on emergency basis / less priority to preventive maintenance)</td>
<td>Systems strengthened &amp; usage of machinery increased (Man entry into sewers is now completely prohibited)</td>
</tr>
<tr>
<td>High volumes of rain water getting into systems</td>
<td>Problematic areas need to be provided with storm water drains by Corporation of Chennai.</td>
<td>Co-ordination with other service departments to ensure effective dewatering.</td>
</tr>
<tr>
<td>Untreated sewerage into water ways</td>
<td>Sewage Pumping Stations, Pipelines and Sewerage Treatment Plants</td>
<td>Approved. Works already taken up (JnNURM/ Chennai Mega City Development Mission).</td>
</tr>
<tr>
<td>Illegal disposal of sewage</td>
<td>Enforcement</td>
<td>Being done</td>
</tr>
<tr>
<td>Treated sewage wasted in water ways after incurring huge cost towards treatment. (The treated sewage is a potential resource for saving the fresh water)</td>
<td>TTRO</td>
<td>About 35 MLD of secondary treated sewage is supplied to industries apart from 7 MLD of raw sewage. Another 45 MLD of TTRO water is proposed to be supplied to industries by 2016</td>
</tr>
</tbody>
</table>
### Power Generation

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity (MLD)</th>
<th>Power (KwH/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. From 4 Old STPs</td>
<td>270</td>
<td>31,000</td>
</tr>
<tr>
<td>2. From 2 STPs under construction</td>
<td>114</td>
<td>16,000</td>
</tr>
<tr>
<td>3. From Koyambedu STP</td>
<td>120</td>
<td>17,000</td>
</tr>
<tr>
<td>4. From Villivakkam STP</td>
<td>150</td>
<td>22,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>86,000</strong></td>
</tr>
</tbody>
</table>

### Expected Bio gas power in the year 2030

1,72,000 KwH/day

### Expected revenue from Bio gas plant (120 MLD STP at Koyambedu)

- **a. Electricity units**
  - 17,000 units x Rs.4.50 x 30 days
  - For 12 months
  - Rs.22,95,000
  - Rs.2.75 crore/annum

- **b. Clean Development Mechanism (CDM)**
  - Investment for CDM credit (120 MLD x 0.8 T x 365 days x Rs.720)
  - Rs.2.52 crore/annum

### Total earnings/year (a+b)

- Rs.5.27 crore

### Investment for gas generation

- Rs.27.09 crore

### Pay back period (27.09/5.27)

- 5.1 years (say 5 years)

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**Note:** CMWSSB is in the process availing Carbon Credit for reduced carbon emissions and saving power
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Location of STP</th>
<th>Capacity of gas engine (KW)</th>
<th>Gas Engine commissioned on</th>
<th>Total power generated up to Jan 2013 (KWH)</th>
<th>TNEB power savings up to Jan 2013 Rs in lakhs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kodungaiyur 110mld</td>
<td>1064</td>
<td>Aug 06</td>
<td>2,95,72,570</td>
<td>1184.67</td>
</tr>
<tr>
<td>2</td>
<td>Perungudi 54mld</td>
<td>1064</td>
<td>Aug 06</td>
<td>1,96,06,920</td>
<td>785.08</td>
</tr>
<tr>
<td>3</td>
<td>Perungudi 60mld</td>
<td>1064</td>
<td>Jan 12</td>
<td>17,82,890</td>
<td>72.30</td>
</tr>
<tr>
<td>4</td>
<td>Koyambedu 60mld</td>
<td>625</td>
<td>Oct 05</td>
<td>1,30,75,000</td>
<td>523.75</td>
</tr>
<tr>
<td>5</td>
<td>Nesapakkam 40mld</td>
<td>469</td>
<td>May 06</td>
<td>1,17,81,142</td>
<td>471.74</td>
</tr>
<tr>
<td>Total</td>
<td>324 mld</td>
<td>4286</td>
<td></td>
<td>7,58,18,522</td>
<td>3037.54</td>
</tr>
</tbody>
</table>
- Operation of Mobile water supply system
- Outsourcing of Design/Consultancy services
- Staff transport operations
- O&M of water and sewerage installations
- Water extraction from private sources
- Computerization of Billing and Collection
HISTORY OF PPP IN METROWATER

1978 - Operation of Mobile Water Supply

1985 - Security Operations/Staff Transport

1990 - WTP - 300 MLD (DBOT) / O&M of Sew. Pumping STNS.

1995 - O&M of WTP/STP/WDS/Well Fields/Water Extraction & Transportation

2000 - DBOT (NVP - 180 MLD) Raw Water Pumping Station, Treatment Plant, Treated Water Pumping Station, 228 km Pipeline & WDS - After Construction O&M for 5 Years

2002 - WTP - 530 MLD, WTP (DBOT) & 4 STPs (264 MLD) and one Depot at Manali New Town

2004 - DBOOT 100 MLD De-Salt Plant

2005-2012

PPP INITIATIVES

TIME
<table>
<thead>
<tr>
<th>Details</th>
<th>Quantity</th>
<th>Cost Savings %</th>
</tr>
</thead>
<tbody>
<tr>
<td>O &amp; M of Water Treatment Plant</td>
<td>2 No (3 Nos)</td>
<td>10</td>
</tr>
<tr>
<td>O &amp; M of Water Distribution Stations</td>
<td>16 Nos (16 Nos)</td>
<td>30</td>
</tr>
<tr>
<td>Water Transport Operations</td>
<td>Full</td>
<td>18.5</td>
</tr>
<tr>
<td>O &amp; M of Sewage Treatment Plants</td>
<td>6 Nos (6 Nos)</td>
<td>33</td>
</tr>
<tr>
<td>O &amp; M of Sewage Pumping stations</td>
<td>158 Nos (218 Nos)</td>
<td>50</td>
</tr>
</tbody>
</table>
PPP – The Cost Advantages

**1990-91**
- O & M Cost: 37%
- Employee cost: 44%
- Interest: 7%
- Depreciation: 9%
- Office & Admn.: 3%

**2011-12**
- O & M Cost: 42%
- Employee cost: 17%
- Interest: 1%
- Depreciation: 13%
- Office & Admn.: 27%
## Cost Comparison for Treatment of water at different Water Treatment plants

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description</th>
<th>Cost for Treatment of 1 kilo litre of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red hills system</td>
<td>1.41</td>
</tr>
<tr>
<td>2</td>
<td>Veeranam</td>
<td>2.26</td>
</tr>
<tr>
<td>3</td>
<td>Chembarambakkam</td>
<td>2.24</td>
</tr>
<tr>
<td>4</td>
<td>Surapet</td>
<td>3.78</td>
</tr>
<tr>
<td>5</td>
<td>Wellfields</td>
<td>12.94</td>
</tr>
<tr>
<td>6</td>
<td>Desal water (Under DBOOT)</td>
<td>48.63</td>
</tr>
<tr>
<td></td>
<td>Desal water (Under EPC+7 yrs Maintenance)</td>
<td>30.00</td>
</tr>
<tr>
<td>7</td>
<td>Tertiary treated water for Industrial use (Proposed)</td>
<td>45.00</td>
</tr>
</tbody>
</table>