Chapter - VII

INFRASTRUCTURE

Water Supply

Introduction

One of the major problems faced in CMA is the inability of the administration to keep pace with the increasing need for utility services particularly water supply and sewerage. This problem is not unique to Chennai alone and almost all the rapidly growing cities in India share the same.

7.02 In Chennai City, Chennai Municipal Corporation was responsible for construction, operation and maintenance of water supply system till August 1978. It was transferred to the (then newly formed) CMWSSB with all assets and liabilities. The major supply sources viz. Poondi reservoir, Cholavaram lake and Redhills lake are under the control of the State PWD (Irrigation); further the PWD (Ground Water Cell) is responsible for the investigation of ground water resources within CMA to augment supplies.

7.03 In the cases of large-scale neighbourhood developments made by TNHB such as Anna Nagar, K.K. Nagar, J.J. Nagar, Ashok Nagar, South Madras Neighbourhood schemes etc., water supply facilities within the area had been provided by TNHB (usually with ground water sources or extending the city water supply) and after installation, maintenance had been transferred to CMWSSB. The same is the case in cases of large-scale TNSCB developments also.

7.04 In the rest of the CMA, construction and water supply schemes were undertaken mostly by TWAD Board at the cost of the local body concerned and after completion, transferred to the local body for future operation and maintenance. CMWSSB is now planning to cover these areas with water supply and sewerage services.

City System

7.05 Chennai City water supply is drawn from the Red hills lake located about six km. from City in the northwest along the GNT Road. This lake mainly receives its supply from the Kosasthalaiyar River across which a dam was constructed to create reservoir at Poondi. The anicut constructed in its downstream at Tamaraipakkam diverts the flow through the upper supply channel to Cholavaram Lake; from there it flows to Redhills Lake. A separate lined channel from Poondi reservoir connects the upper supply channel which prevents any possible loss of transmission through dry beds of the river. The flow into these sources is seasonal.

7.06 A number of small lakes are also connected in the northwest of CMA to the Redhills Lake and the run-off in the catchment areas of these lakes are fed to the Redhills Lake.

7.07 Water tapped from the Redhills Lake is filtered enroute, conveyed through closed conduits to Kilpauk Water Works, treated therein and distributed to various parts of the City.

7.08 Nucleus of the protected surface water supply system now in existence in Chennai City was formed in 1872 while major inputs including filtration and pumping commenced in 1914. The scheme as it exists today consists of the surface storages at Poondi, Cholavaram and Redhills lakes with a total capacity of 183 million cubic metres fed by the Kosatalaiyar river. The maximum water levels of Redhills and Cholavaram lakes were raised in 1972 and the irrigation rights under the lakes had also been acquired by the Government. The lakes are mostly fed by North East monsoon, which is active only for a few months in a year between October and December.

7.09 A statistical analysis of the combined storage of the lakes for a period of thirty years has indicated that the safe potential from the lakes at 95% probability is only 142 mld. As the lakes are shallow, evaporation losses are as high as 43% at present.

Ground Water System

7.10 The ground water sources are ground water from well fields, coastal aquifer; brackish water based Reverse Osmosis Plants, Neyveli Aquifer etc.

7.11 During 1960s & 70s three aquifers at Minjur, Panjetty and Tamaraipakkam located in the north and northwest of the City and the aquifers along the coastal belt from Thiruvanmiyur to Kovalam were identified and tapped. The area North East of the City was taken up for extensive hydro- geological study as part of a UNDP aided project to assess the potential for development of a ground water source. Studies have identified a 'buried channel', which should have been the course of Palar river thousands of years back. In this course, a well field was identified extending to a stretch of about 50 km. length and 5 km. average width hydro geologically suitable for extraction of ground water. The following well fields have been developed.

Table No.7.01 Details of Well Fields				
Well Fields	Year of Commission	No. of wells	Yield MLD during design	Average yield from Dept. wells in 2005
Tamaraipakkam	1969	2 out of 30	50	1.60
Panjetty	1969	1 out of 13	41	0.08
Minjur	1969	5 out of 9	34	3.10
Poondi	1987	4 out of 12	27	1.20
Flood Plains	1987	0 out of 5	14	0
Kannigaiper	1987	0 out of 5	14	0.01
Total		12 out of 74	180	5.99

Source: CMWSSB

7.12 Above table clearly brings out the depletion of ground water source during the last 30 years in that area due to increase in demand resulting in overdrawal of ground water. In addition, due to severe scarcity, CMWSSB has hired private agricultural wells from 2000 to augment water supplies. The average yield from such sources during 2005 is to the tune of 77 MLD.

Details of hiring of Private Agricultural Wells		
Sl.No.	Year	Average Yield in MLD
1	2001	37
2	2002	45
3	2003	55
4	2004	70
5	2005	77

7.13 In the recent past the agriculture activity in the ayacut areas of Chembarambakkam tank has been reduced drastically because of conversion of lands for urban uses and for reasons of uneconomical production costs. Now the Chembarambakkam tank (located about 12 km. from the City in the west) is also used as one of the main sources of water supply to the City. Veeranam tank (located about 230 km. from the City in the south) has been identified as an additional source of water supply to Chennai.

Table No.7.02 Characteristics of Existing Surface Reservoirs						
Reservoir	Maximum Water Elevation (Metre)	Drawl of elevation (Metre)	Maximum usable volume (million)	Full Area surface (million sq.ft.)	Mean Depth (Metre)	Catchment Area (Sq.km.)
Poondi	42.67	34.14	91.44	376.74	8.53	1983
Cholavaram	19.66	14.22	24.93	55.76	5.44	28.49
Redhills	15.30	8.59	87.02	195.15	6.71	60.00
Chembarambakkam	26.03	18.72	103.15	711.18	7.31	357.00
Veeranam	14.48	12.34	37.61		2.14	422.40
Total			306.54			2850.89

Ground Water Regulation

7.14 To regulate and control the extraction, use or transport of ground water and to conserve ground water, the Chennai Metropolitan Area Ground Water (Regulation) Act, 1987 was enacted. The preamble of the Act is extracted below:

> "There is often acute scarcity of water due to consecutive failure of monsoon rains; the available water in the Poondi, Cholavaram and Red Hills reservoirs, which are the main sources of supply of water to the Chennai City, is inadequate to meet the requirements for drinking and other domestic purposes of the people in the Chennai City;
>
> The United Nations Mission, which investigated the possibility of supplementing water supply to Chennai, has recognized that a better economic answer might lie in the development of groundwater potential and had identified the Minjur, Duranallur-Korteliyar basin, the Poondi, Korteliyar Flood Plains and Kannigaipper aquifers and also Poonamallee-Porur aquifer in Cooum-Adayar basin as having groundwater for extraction;
>
> The United Nations Development Programme which conducted pre-investment studies on improving water supply and sewerage systems of chennai concurred with the estimation of the Geological Survey of India that groundwater can be extracted from the twenty kilometre stretch of the coastal zone between South Madras and Kovalam;
>
> The Madras Metropolitan Water Supply and Sewerage Board has reported that all other possibilities of augmenting water supply to the Chennai City have been exhausted and that it is necessary to regulate and control the extraction and use of ground water in any form and to conserve the same in the City of Chennai and the district of Chengalpattu and to regulate and control the transport of groundwater;
>
> Based on the United Nations Development Programme studies, a scheme for artificial re-charge of the Arni-Korteliyar basin with excess flood water flowing into the sea is to be taken up by interlinking Arni and Korteliyar at two or more feasible points and also by constructing sufficient number of check dams at the appropriate places in the Korteliyar river course;
> Such re-charge will enable optimum utilisation of ground water and formation of a hydraulic barrier against seawater intrusion;
>
> The Government have, after careful examination of all aspects, decided that it is necessary in the public interest to regulate and control the extraction and use of

groundwater in any form and to conserve the groundwater in the City of Chennai and certain revenue villages in the district of Chengalpattu and to regulate and control the transport of groundwater." The Government of Tamil Nadu has enacted the Act viz. Madras Metropolitan Area Ground Water (Regulation) Act 1987.

7.15 The Act is being enforced by the CMWSSB in the Chennai City and the District Collector in the rest of CMA, and it provides for grant of permit to sink wells in the scheduled areas, registration of existing wells and use of ground water in the area, license for extraction, use or transport of ground water etc.

7.16 The entire area within the Chennai City has potential for restricted drawal through shallow open wells, and tube wells, and these types of wells are predominant in the premises within the City. Though unprotected, it helps to supplement the limited quantity of protected water available from the public system. Assuming a conservative figure of drawal of 50 lpcd of ground water, for the population of Chennai about 45 million in 2005, estimated drawal will be in the order of 225 MLD. Details on TDS level in ground water in Chennai are given in the Annexure VI-A. The level of TDS of sample wells varied from 500 ppm to 2500 ppm.

7.17 Estimated safe yield and average yield at various sources for water supply to Chennai in the year 2004 is given below:

Table No.7.03 Safe Yield from different sources 2004

Sl.No.	Source	Average yield in MLD	Safe yield in MLD
1.	Surface Water including I stage Krishna	17.89	500
2.	New Veeranam Project a) Veeranam Lake b) Neyveli Aquifer	 148.42 50.56	 180 65
3.	Well fields	85.23	100
4.	Distance Source	63.16	100
5.	Porur Wells	2.96	3
6.	Southern Coastal Aquifer	2.12	4
Total		370.34	952

Source: CMWSSB

7.18 The sources of water supply to Chennai in the year 2004 is given in the Table below. The areas served by it are the Chennai City, adjoining urban areas (10 sq.km.) and industries at Manali.

Table No.7.04 Sources of Supply of Water to Chennai, 2004	
Source (in ML) for the whole year 2004	
Veeranam Lake	14,842
Redhills Lake	4,155
Rain water	1,691
Chembarambakkam	133
Erattai Eri	207
Well fields	31,195
Southern Coastal Aquifer	776
R.O. Plants	182
TWAD Source	275
Porur Wells	210
Neyveli Aquifer	5,966
Distance Source	21,357
Total	80,988

Source: CMWSSB

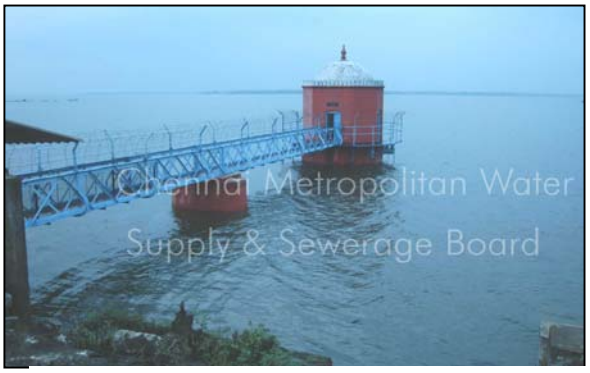
7.19 When there was acute scarcity of water in 2004 to the City due to monsoon failure and it could not be supplied through pipe, CMWSSB had ably managed the crisis by supplying through tanker lorries and the water supply through tankers were 9,930 nos./day (average) from January, 2004 to June, 2004 and 9,003 nos./day (average) from July to December, 2004.

Supply Levels

7.20 The average water supply in Chennai city is 90 lpcd. In slums within the City the level of water supply is 25 lpcd. The current water supply from all the sources is of the order of 550 MLD. However, during the summer season, in times of reduced storage, the supply levels would be as low as 300 MLD. In addition, CMWSSB also provides bulk water to the surrounding municipalities to supplement the other sources.

Treatment Capacities

7.21 The availability of treatment capacities at 750 MLD is much more than the current supply levels. The treatment capacity appears to be high as the current supply is lower than the anticipated levels and would suffice the current requirement if a full supply is envisaged. The location and capacities of treatment plants is presented in Table No.7.05.



View of Redhills Reservoir

Table No. 7.05: Treatment Capacities		
Sl. No	**Location**	**Capacity-MLD**
1.	Kilpauk	270
2	Red hills	300
3	Veeranam	180
	Total	750

Source: CMWSSB

7.22 In addition, a 530 MLD capacity treatment plant at Chembarakkam is currently under construction taking the total capacity to 1280 MLD. This is constructed in anticipation of full realization of Krishna Water to the City, which would augment the existing supply levels.

Distribution System and Storage Capacity

7.23 The distribution network in Chennai City covers a length of 2,582 Km and is divided into 159 Divisions. About 98% of the population of the City is covered through piped supply and the balance is through water tankers. The water is distributed through 27 main and subsidiary water distribution stations comprising Over Head Tanks and Under Ground Tanks. The combined storage capacities are of the order of 322 ML. The per capita supply in Chennai Corporation area, as of July 2006, is 105 lpcd. The Chennai City water supply distribution network has been divided into 16 Zones with independent water supply distribution stations and distribution network with feeder mains. In 12 Water Distribution Stations and 11 distribution network zones, improvement works have been completed and the supply level is almost equitable. For balance 4 Water Distribution Stations and 5 zonal distribution networks, improvement works have been proposed under JNNURM funding, since the earlier attempt to include in the World Bank assisted projects had not been finalised. On completion of the improvement works in the balance 4 Water Distribution Stations and 5 distribution network systems, the supply level will be almost equitable.

7.24 The ULBs manage their own storage capacity, the present supply levels are low and would need augmentation in the future.

Master Plan for Water Supply- Distribution System

7.25 A master plan for the management of the water supply and sewerage for the City, which was prepared in the year 1978, was revised in the year 1991 in order to receive and utilize the water for City supply under Telugu Ganga Project from Andhra Pradesh and later updated in 1997. The master plan contemplated the construction of additional water treatment plant, water distribution stations, laying of additional transmission mains and strengthening of the existing distribution system. The master plan envisages

re-organizing the existing distribution system network to the 16 zones and adequate infrastructure to ensure equitable distribution of water supply. The implementation of the master plan has been taken up in stages for water supply management in Chennai city to utilise the Krishna water received from Andhra Pradesh.

7.26 The size of the pipes constituting the distribution system ranges from 100 mm to 1500 mm in diameter with a total length of about 2,582 km. The existing system largely consists of C.I. pipes. In some specific areas PVC mains exist. Of the total length, 85% is estimated to be of diameter 200 mm and less. Also, about 50% of the smaller sized distribution pipelines are estimated to be of age 50 years or more. Ageing of pipeline, incrustation due to intermittent supply and other factors have contributed to the reduction in the capacity of the distribution system resulting in low pressure in the distribution system. More than 50% of the total system is estimated to have zero residual head. Chennai City has been expanding at a fast rate and because of this, it is found difficult to meet the demand, especially at the tail end areas. The 300 MLD capacity Water Treatment Plant was constructed at Red hills with World Bank assistance under the first Chennai Water Supply Project and 3 Nos. of transmission mains were also laid to facilitate the treated water to different water distribution stations located in the City.

Coverage in Slums

7.27 About 3.5 lakhs population of Chennai in slums comprising of 58,631 households are covered through piped supply, tankers and public fountains. CMWSSB supplies water through 8,916 public fountains and 3,542 mini tanks to augment the piped water supply. About 2/3rd of these facilities cater to low income and slum population. Ground water for supplementation purposes is also drawn through 7,726 India Mark II pumps.

Second Chennai Project

7.28 The Second Chennai Water Supply Project was taken up by CMWSSB during February 1996 with the World Bank Assistance at a cost of Rs.778.79 crores and most of the works contemplated under this project has been completed. Some of the major works such as construction of Water Distribution stations (7 nos.), Laying of Clear Water Transmission mains (36 km.), and Strengthening of Water Distribution system in 11 zones (660 km.) out of 16 zones were taken up, including leak detection rectification works covering about 70% of Chennai City Area. Benefits attained due to the implementation of the above project are:

(a) Piped water supply availability has been increased resulting in reduction in defective streets with improved service level and pressure in the mains.

(b) Reduction in the radius of the water distribution station resulted in increased piped water supply availability with reduced quantity of supply.

(c) The level of unaccounted for water has been reduced resulting in additional water availability to the Chennai citizens.

7.29 Due to the construction of additional water treatment plant of 300 MLD capacity at Red Hills in 1996, the work of refurbishment of the existing Kilpauk Water Treatment Plan of capacity 270 MLD was taken up at a cost of Rs.24.57 crores and all the works were completed.

Chennai City Water Supply Augmentation Project-I

7.30 Chennai Water Supply Augmentation Project-I (to add 180 MLD water to Chennai City water requirement) was taken up by CMWSSB in 2004 at a cost of Rs.720 crores. It is to draw 190 MLD of raw water from Veeranam Lake near Sethiathope, situated in Cuddalore District at about 230 km. from Chennai City, pump the raw water to about 20 km. through the pipeline to Vadakuthu for treatment, pump the treated water from Vadakuthu for a distance of about 8 km. to the Break Pressure Tank at Kadampuliyur ridge point and then convey the water from this ridge point by gravity for about 200 km. to the Water Distribution Station at Porur in Chennai and distribute to the public through the distribution network system.

Chennai City Water Supply Augmentation Project-II

7.31 The Government on 27.2.2004 has accorded the revised administrative approval for the Chennai Water Supply Augmentation Project-II (CWSAP-II) at an estimated cost of Rs.124.00 crore. The objective of this project is to augment water supply to the City by intercepting the rainwater runoff into the sea by the construction / rehabilitation of check-dams across Cooum, Adyar and Palar rivers. The water thus collected from the Vayalur check-dam and the available water in Kolavoy lake will be treated in the proposed Water Treatment Plant at Mangalam and will be transmitted to the City. The aim of the project is to tap 20 MLD of water from different sources.

7.32 The following are the components of work to be implemented under the CWSAP-II:

(1) Construction of check-dam at Vayalur across Palar river.

(2) Infrastructure for drawal of 20 MLD from Checkdam at Palar (drawal and conveyance).

(3) Treatment Plant at Vayalur and laying pumping main upto Pallipattu with an intermediate pumping at Tiruporur.

(4) Construction of check-dams across Manapakkam, Nandampakkam, Anakaputhur and Cowl Bazaar.

(5) Improvements to two Check-dams across Cooum at Paruthipattu and Kannapalayam.

This project is scheduled to be completed by end of 2007.

Telugu Ganga Project

7.33 Under this project 12 TMC of water from Krishna River will be received and stored in Poondi, Redhills, Cholavaram and Chembarambakkam lakes.

Construction of 530 MLD capacities Water Treatment Plant at Chembarambakkam

7.34 In order to treat additional water to be drawn under the Telugu Ganga Project additional treatment plant with capacity of 530 MLD is constructed at Chembarambakkam with an estimated cost of Rs134.90 crores with assistance from the French Government and a transmission main at a cost of Rs.90.00 Crores.

Desalination Plant

7.35 Keeping in view, the chronic problem of water scarcity in Chennai and adjoining areas due to frequent failure of the monsoons, Government decided to set up a desalination plant for supply of potable water to the residents of Chennai and adjoining areas. Accordingly CMWSS Board has proposed to construct a 100/200 MLD Sea Water Desalination Plant at Minjur on Design-Build-Own, Operate and Transfer (DBOOT) basis. The required land of 120 acres has also been identified near Minjur. The project is scheduled to be completed in 18 months time and is expected to be commissioned by 2007.

Third Chennai Project

7.36 CMWSSB has proposed to take up further systematic improvement projects in water supply, both for Chennai City and adjacent Urbanised Local Bodies as "Third Chennai Project" with World Bank assistance at a cost of Rs.750 crores. In order to improve the sources, works are proposed for deepening and desilting of Ambattur tank, Korattur tank and Madhavaram tank and for rehabilitation of Porur tank besides formation of check-dams. It is also proposed to install water meters to all the consumers to achieve sustainable revenue. The following are some of the major works envisaged under the proposed Third Chennai Project.

(a) Strengthening of water Distribution system in the left out 5 zones:

Under Second Chennai Project, out of 16 zones, works on strengthening of water distribution system was taken up and completed in only 11 zones. Due to the benefits achieved under Second Chennai Project, it is now proposed to take up the strengthening of the distribution system in the remaining 5 zones also viz. Anna Poonga, Kilpauk,

Triplicane, Southern Head works and KK Nagar. The total length of pipelines to be laid is about 305 km. at a total cost of Rs.150 Crores.

(b) Infrastructure facility to draw additional ground water from A.K. Basin:

Under the Second Chennai Project, the consultancy study to reassess the ground water potential in Araniar Kortalayar Basins is under way and will be carried over into the Third Chennai Project after ascertaining the sustainable yield.

Rest of CMA

7.37 Potable water supply system exists almost in all the municipalities with CMA. Alandur, Pallavaram, Tambaram, Anakaputhur and Pammal Municipalities have water from Palar River as source, and other municipalities have CMWSSB bulk supply or the ground water as source. Water supply in Panchayat areas are concerned, it is by local wells and public taps.

Water Demand

7.38 The rate of consumption of water in some Indian cities is given below:

Table No.7.06 Water Consumption in Indian Cities

Town	Consumption litres per capita per day
Bangalore	140
Mumbai	260
Delhi	270
Chennai City	107*
Pune	220

Source: CMWSSB

* 2006-2007

7.39 It was estimated in the Madras Water Supply and Sanitation Project report (1987) that the requirement of water will be 165 lpcd based on need based assessment. Future requirements of water at the rate of 150 lpcd for the City and 100 lpcd for the rest of CMA have been estimated and the estimates are given in the table below:

Table No.7.07 Estimates of water requirements					
I. Chennai City		Year			
		2011	2016	2021	2026
1.	Population in lakhs	49.95	52.39	55.4	58.56
2.	Water requirement in MLD for the resident population				
(a)	@ 150 lpcd	749	786	831	878
(b)	@ 120 lpcd	599	629	665	703
(c)	@ 100 lpcd	500	524	554	586
3.	Water requirement in MLD for the other than residential use such as office, commercial, industrial premises and other places of employment, education, etc.				
(a)	@ 30% of 2(a) above	225	236	249	264
(b)	@ 25% of 2 (b) above	150	157	166	176
(c)	@ 20% of 2(c) above	100	105	111	117
4.	Industrial use				
(a)	@ 10% of the 2(a) above	75	79	83	88
(b)	@ 10% of the 2(b) above	60	63	66	70
(c)	@ 10% of the 2(c) above	50	52	55	59
5.	Total requirement				
	@150 lpcd	1049	1100	1163	1230
	@120 lpcd	809	849	897	949
	@100 lpcd	649	681	720	761
II. Municipalities in CMA					
1.	Population in lakhs	21.75	25.60	30.20	35.69
2.	Water requirement in MLD for the resident population				
(a)	@ 125 lpcd	272	320	378	446
(b)	@ 100 lpcd	218	256	302	357
(c)	@ 75 lpcd	163	192	227	268
3.	Water requirement in MLD for the other than residential use such as office, commercial, industrial premises and other places of employment, education, etc.				
(a)	@ 30% of 2(a) above	82	96	113	134
(b)	@ 25% of 2 (b) above	54	64	76	89
(c)	@ 20% of 2(c) above	33	38	45	54
4.	Industrial use				
(a)	@ 10% of the 2(a) above	27	32	38	45
(b)	@ 10% of the 2(b) above	22	26	30	36
(c)	@ 10% of the 2(c) above	16	19	23	27
5.	Total requirement				
	@125 lpcd	381	448	529	625
	@100 lpcd	294	346	408	482
	@75 lpcd	212	250	294	348

III. Town Panchayats					
1.	Population in lakhs	5.89	7.41	9.45	12.21
2.	Water requirement in MLD for the resident population				
(a)	@ 100 lpcd	59	74	95	122
(b)	@ 80 lpcd	47	59	76	98
(c)	@ 60 lpcd	35	44	57	73
3.	Water requirement in MLD for the other than residential use such as office, commercial, industrial premises and other places of employment, education, etc.				
(a)	@ 30% of 2(a) above	18	22	28	37
(b)	@ 25% of 2 (b) above	12	15	19	24
(c)	@ 20% of 2(c) above	7	9	11	15
4.	Industrial use				
(a)	@ 10% of the 2(a) above	6	7	9	12
(b)	@ 10% of the 2(b) above	5	6	8	10
(c)	@ 10% of the 2(c) above	4	4	6	7
5.	Total requirement				
	@100 lpcd	82	104	132	171
	@80lpcd	64	80	102	132
	@60 lpcd	46	58	74	95
IV. Village Panchayats					
1.	Population in lakhs	10.59	12.96	15.99	19.88
2.	Water requirement in MLD for the resident population				
(a)	@ 80 lpcd	85	104	128	159
(b)	@ 70 lpcd	74	91	112	139
(c)	@ 60 lpcd	64	78	96	119
3.	Water requirement in MLD for the other than residential use such as office, commercial, industrial premises and other places of employment, education, etc.				
(a)	@ 30% of 2(a) above	25	31	38	48
(b)	@ 25% of 2(b) above	19	23	28	35
(c)	@ 20% of 2(c) above	13	16	19	24
4.	Industrial use				
(a)	@ 10% of the 2(a) above	8	10	13	16
(b)	@ 10% of the 2(b) above	7	9	11	14
(c)	@ 10% of the 2(c) above	6	8	10	12
5.	Total requirement				
	@80 lpcd	119	145	179	223
	@70lpcd	100	122	151	188
	@60 lpcd	83	101	125	155

Table No.7.08 Estimate of Water Requirement (CMA)					
Chennai Metropolitan Area		Year			
		2011	2016	2021	2026
1.	Population in lakhs	88	100	112	126
2.	Water Requirement in MLD for the resident population				
a)	Scenario I	1165	1284	1431	1606
b)	Scenario II	938	1035	1154	1296
c)	Scenario III	762	838	933	1046
3.	Water Requirement in MLD for the others from residential use such as office, commercial, industrial premises and other places of employment, education etc.				
	Scenario I	349	385	429	482
	Scenario II	235	259	289	324
	Scenario III	152	168	187	295
4.	Industrial Use				
	Scenario I	116	128	143	161
	Scenario II	94	103	115	130
	Scenario III	76	84	93	105
5.	Total Requirement				
	Scenario I	1631	1797	2003	2248
	Scenario II	1267	1397	1558	1750
	Scenario III	990	1090	1213	1360

7.40 The sources presently available and also to be tapped in immediate future by CMWSSB are given in table No. 7.09.

Table No. 7.09 Assessment Of Abstractable Reliable Quantity of Water from Various Sources			
Sl. No.	**Name of Source**	**Safe Yield in MLD**	**Remarks**
1	Poondi - Cholavaram - Red Hills Lake System	227	Based on the assessment during 1997 revision of Master Plan for water supply.
2	Groundwater aquifer from Northern Well Field	68	
3	Other sources like Southern Coastal Aquifer, Rettai Eri, Porur, etc.	5	
4	Receipt of Krishna Water from Telugu Ganga Project (when full agreed quantity of 930 MLD (12 TMC) supplied)	837	10% loss from entry point to Poondi Lake has been considered.
5	Veeranam Lake (CWSAP-I)	180	
6	Desalination Plant	200	a) 100 MLD in 2008 b) 100 MLD in 2009
7	Local sources including Palar River in the CMA area other than City limits.	32	Based on the assessment during 1997 revision of Master Plan for water supply.
8	Abstractable quantity of local groundwater in the city for the use	240	

	of other than drinking and cooking purposes.		
9	Waste water reuse a) Already in use b) Expected in future (SIPCOT use)	 45 120	From 2009
Total		**1954**	

7.41 The source as indicated above will meet the demand up to the year 2011. There is a gap of nearly 300 MLD to meet the CMA demand for the year 2026. This gap will be met by water conservation measures, promoting recycling and by identifying additional sources. The Redhills source has to be protected from possible contamination due to development in the catchment area by not allowing reclassification of land uses or expansion / addition in other zones.

Rain Water Harvesting

7.42 The importance for conservation of water and rainwater harvesting was understood and due consideration and thrust were given from early 90's itself in Chennai. While issuing Planning Permission for construction of major developments such as flats, residential developments, office, shopping and other commercial complexes, the condition to provide rain water-harvesting structures within the premises was imposed and ensured to be provided before issue of Completion Certificates. Provision of rainwater structures in all types of developments, irrespective of size or use was made mandatory by amending DCR and Building Byelaws in the year 2001, not only for the buildings proposed to be constructed but also for all the existing buildings. After implementation of this scheme widely in CMA, a significant increase in the ground water levels and also quality of ground water was noted.

7.43 In 2001, it was also made mandatory that all centrally air-conditioned buildings shall have their own wastewater reclamation plant and shall use reclaimed wastewater for cooling purposes.

Sewerage

7.44 Chennai City Sewerage System was designed in 1910 for an estimated 1961 population of 6.6 lakhs at the rate of 114 lpcd, as a separate system. The system then allowed for admission of storm water from house courtyards and roofs through gullies. The city was divided as north, west and south (independent) drainage areas and sewage from each area was collected by relay pumping and conveyed to the pumping stations at Napier Park, Purasawalkam and Royapuram, and finally discharged into the sea at Kasimedu out-fall. Kodungaiyur sewage farm was developed in 1956 and a portion (27

mld) of the sewage collected at Purasawalkam pumping station was discharged through force mains to Kodungaiyur farm.

7.45 A comprehensive improvements to the city sewerage system was designed in 1958 for an estimated 1976 population of 25.5 lakhs and 1991 population of 27.2 lakhs at a sewage flow rate of 110 lpcd in 1976 and 180 lpcd in 1991; the City was also divided into five zones with proposals for five independent disposal works. It was planned to isolate the system of collection, transmission and disposal of sewage in each zone in order to obviate the difficulties of the relay system.

Coverage

In the present Chennai City Corporation area of 176 sq.km., the sewerage system now covers 99% of the city area. There are 5,15,560 sewer connections as on date to serve the population of Chennai City through a network of 2,663 kms of sewer and 180 sewage pumping stations.

Capacity of the Sewage Treatment Plan

7.46 The sewage generated from Chennai City is treated in 9 Sewage Treatment Plants as detailed below:-

Sl.No.	Location of the Plants	No. of Units	Treatment Capacity in MLD
1.	Kodungaiyur	3 Nos.	270
2.	Koyembedu	2 Nos.	94
3.	Nesapakkam	2 Nos.	63
4.	Perungudi	1 No.	54
5.	Villivakkam	1 No.	5
Total		**9 Nos.**	**486**

7.47 Apart from those zonal systems, other small systems developed by the TNHB in their neighbourhood scheme areas are also functioning and these are connected to the nearest mains of the zone in which they lie.

7.48 As the capacity of sewers was limited, during rainy days they became surcharged due to ingress of storm water. Any surplus of sewage in excess of pumping stations capacity was drained into the nearby natural water courses of the city viz. Cooum river, Adyar river, Buckingham canal and Otteri Nalla.

Chennai City River Conservation Project

7.49 Based on their master plan, CMWSSB had conceived a comprehensive project for sewerage system improvements under the umbrella Chennai City River Conservation Project (CCRCP). In order to cope up with the increased sewage flow resulting from water supply augmentation schemes under implementation, and to prevent the overflow of sewage into the City waterways, the Chennai City River Conservation Project has been taken up at a cost of Rs.720.15 Crores with Government of India grant of Rs.491.52 Crores and the remaining Rs.228.63 Crores borne by CMWSSB. The Project includes investments for providing additional sewage interceptor pipe lines, replacing sewer mains which are worn out, and enlarging the capacities of pumping stations and force mains to cope with the flow in the year 2021. The entire Project contemplated under NRCD share consists of 16 Packages. Packages 1 to 12 consist of interceptor and diversion of works, improvements to pumping station and pumping mains. Package 13 to 16 consists of construction of Sewage Treatment Plants. The works of interceptors, pumping mains, gravity mains, pumping stations and construction of 4 Sewage Treatment Plant units at Perungudi (54 mld capacity), Koyambedu (60 mld capacity), Nesapakkam (40 mld capacity) and Kodungaiyur (110 mld) capacity have been completed.

JBIC Project

7.50 CMWSS Board took up implementation of Chennai Sewage Renovation and Functional Improvement Project under JBIC funds. The following 2 components were taken up for implementation:

(a) **Effluent Conveyance System** - envisages pumping of secondary treated sewage from Koyambedu and conveying it to Kodungaiyur through a 900mm dia DI pipe line to be laid over distance of 16.4 km. to Kodungaiyur where TT/RP Plant was proposed for sewage renovation and supply the permeate to industries at Manali.

(b) **Permeate Conveyance System** - The Permeate from the Sewage Renovation Plant (Tertiary Treatment/Reverse Osmosis) would be conveyed to the 12 industries at Manali for their use for various purposes such as cooling, process, boiler teed and others. Subsequently, due to non-availability of demand for recycled water the project was closed in the year 2003.

Rest of CMA

7.51 For the purpose of planning Sewage System, the Metro Water has divided the CMA into four categories as Chennai City, adjoining urbanised areas classified as Adjacent Urban Areas (AUA), Distant Urbanised Areas (DUA) and Rural Areas. The AUA contiguous to Chennai City covers an area of 165 s q.km. with the 6 Municipalities (viz. (i) Alandur, (ii) Ambattur (iii) Avadi, (iv) Thiruvottiyur and (v) Madhavaram and (vi)

Manali two Municipal Townships (viz. (i) Kathivakkam and (ii) Thiruverkadu) 11 Town Panchayats (viz. (i) Chinnasekkadu, (ii) Maduravoyal, (iii) Nandambakkam, (iv) Pallikkaranai, (v) Perungudi, (vi) Porur, (vii) Puzhuthivakkam, (viii) Valasaravakkam, (ix) Kottivakkam, (x) Nerkundram and (xi) Ramapuram) and the Cantonment area.

7.52 The Distant Urbanised Areas (DUA) comprises 6 Municipalities (viz. (i) Pallavaram, (ii) Tambaram, (iii) Anakaputhur, (iv) Pammal, (v) Thiruverkadu, and (vi) Poonamallee) and five Town Panchayats (viz. (i) Minjur, (ii) Naravarikuppam, (iii) Chitlapakkam, (iv) Kundrathur, and (v) Mangadu).

7.53 Some local bodies like Alandur, Valasaravakkam and Thiruvottiyur have implemented the sewerage system in their municipal areas; others are in the process of providing a full-fledged sewerage system and by engaging consultants they have prepared detailed project reports. While formulating the sewerage proposals for the AUAs/DUAs by the consultants, the approval of the CMWSSB is sought for disposal of the sewage to the nearest STPs of Metro sewerage system since the local bodies could not locate the site for construction of STPs in their area to treat the sewage. Due to various reasons including scarcity of source of water, the STPs of Metro system could not realize the projected quantum of sewage immediately. It was found advantageous to dispose the sewage from the AUAs to the nearest STPs of Metrowater, where further capacity augmentation can be taken up in subsequent years.

7.54 The local bodies like Alandur, and Valasaravakkam have implemented the sewerage system in their areas with the contributions by the consumers and loan from the financial institutions.

7.55 Government in March 2005 has directed that Chennai Metropolitan water Supply and Sewerage Board shall be the Nodal Agency for execution, and maintenance of underground sewerage schemes in AUAs and DUAs in the Chennai Metropolitan Area. The Government have directed as follows:

(a) CMWSSB is required to develop proposals for execution of a comprehensive sewerage system for the entire Metropolitan Area in addition to existing sewerage system to Chennai by CMWSSB.
(b) CMWSSB may to the extent possible use the existing and the planned capacity in its sewerage treatment plants to treat the additional sewage load from AUAs and DUAs; and wherever necessary, additional treatment capacity has to be created.
(c) Funds for the project will be mobilised by the concerned local bodies, which will provide the same to CMWSSB.

(d) CMWSSB will execute the entire scheme including the internal sewering within local bodies and house service connection within these areas. The sewer system will also be maintained by CMWSSB for which the local bodies will be required to pay the fees, which shall be negotiated from local bodies with clear agreement.

(e) An important aspect of the proposed scheme will be the issue of public contribution and tariffs, since it will be difficult to have the different amounts prescribed by AUAs and DUAs with a common sewage management network and it will be desirable to have common tariff structure. The local bodies will collect sewerage charges and taxes internally. CMWSSB should include this aspect in the study proposed to be conducted.

(f) If and when the AUAs and DUAs are brought under the umbrella of a greater Chennai Corporation, the CMWSSB would collect charges directly from the consumers.

(g) Although CMWSSB should aim for the utilisation of existing and enhanced capacity in the 4 STPs, restricting the treatment facility to the existing STPs alone may involve considerable additional expenses on construction and maintenance since some local bodies like Avadi, Poonamallee and Tambaram are located at a distance of more than 15-24 km. Hence, it may be desirable to have one or two additional treatment plants of a similar capacity for these DUAs. This aspect can also be taken up in the preparation of Master Plan.

(h) Keeping in view the high costs, CMWSSB should consider a proper phasing for execution of the scheme.

(i) CMWSSB should quickly organise detailed study of coverage indicated above, principles of revenue generation and management of the facilities proposed.

7.56 The comprehensive sewerage system is in existence in (i) Alandur, (ii) Valasaravakkam, (iii) Thiruvottiyur (50% covered) and (iv) Ambattur (partially covered adjoining City limits). The local bodies have formulated proposals and got detailed project reports prepared by the consultants for provision of sewerage system, are (i) Pallavaram, (ii) Tambaram, (iii) Madhavaram, (iv) Kathivakkam, (v) Porur, (vi) Ullagaram Puzhudhivakkam, (vii) Avadi, (viii) Maduravoyal and (ix) Thiruvotriyur (Rehabilitation and Extension). For Pallavaram the work has been entrusted to CMWSSB and the works are expected to be completed by August 2007.

7.57 The local bodies which are not covered presently with the provision of sewerage system in their area, are (i) Ayanambakkam, (ii) Chinnasekkadu, (iii) Manali, (iv) Nandambakkam, (v) Pallikaranai, (vi) Perungudi, (vii) Kottivakkam, (viii) Nerkundram, (ix) Ramapuram, and (x) St. Thomas Mount Cantonment in the AUA, and (xi) Minjur, (xii) Naravarikuppam, (xiii) Chitlapakkam, (xiv) Anakaputhur, (xv) Pammal, (xvi) Thiruverkadu, (xvii) Kunrathur, (xviii) Poonamallee and (xix) Mangadu in the DUA.

7.58 CMWSSB has taken action to conduct studies with the following main objectives:

(i) to prepare Plans and programmes to link the existing/ongoing sewerage system of the local bodies,

(ii) integrating the system with CMWSSB sewerage system, and

(ii) to provide feasibility studies for providing sewerage system to unsewered local bodies.

7.59 The study will cover provision of sewerage system with treatment and disposal arrangements, including examination of reuse options with reference to the demand for such water, nearness to Sewage Treatment Plants etc. for the Adjacent Urbanised Areas and Distant Urbanised Areas in Chennai Metropolitan Area. Four local bodies are presently served by underground sewerage system and nine local bodies are in the process of providing underground services for which consultants were engaged for preparation of DPRs. The study will cover all these existing and proposed UG system to be integrated. The Phase-I study will cover the evaluation of the DPRs of sewerage system prepared by the consultants for the local bodies like: (i) Pallavaram, (ii) Tambaram, (iii) Madhavaram, (iv) Kathivakkam, (v) Porur, (vi) Ullagaram Phuzhudhivakkam, (vii) Avadi, (viii) Maduravoyal, (ix) Thiruvottiyur. The evaluation will cover the population projection in compliance with the CMDA projections, design criteria, treatment option of sewage, whether in a locally identified site or integrating with the available surplus capacity of the STPs of CMWSSB. The cost of conveyance of sewage to the STP of CMWSSB will be compared with the cost of treatment in a locally identified site. The possibility of reuse of treated wastewater to meet the demand by commercial establishments/factories and feasibility of recovering the costs of such treatment will be examined.

7.60 The Phase-II study will cover preparation of feasibility proposals for providing sewerage system to the remaining AUAs and DUAs viz. 19 local bodies and examining the quantum of sewage generation, updating the population estimates, finalising the design criteria in compliance with the system already provided in the other local bodies, preparation of outline scheme, preliminary cost estimates with alternative proposals, economic feasibility based on the alternate cost proposals for phasing of the investment and financial and administrative arrangement for implementation, operation and maintenance of the system. The study will also address the options on the issue of treating the sewage generation in a locally identified site or to integrate with the STP of CMWSSB and recommend the best available option.

7.61 The observation made in the Tenth Five Year Plan report is extracted below:

"It is infeasible to provide underground sewerage or septic tank latrines in the cities and for all residents. In the first place, highly urbanised, industrialised and densely populated urban centres may be provided with sewerage, with priority being given to installing sewage treatment plants to prevent pollution of water sources. For the majority of the urban centres, low cost sanitation is the appropriate technology.

Low cost sanitation is not a programme solely for the urban poor or slum population. It has to be propagated as the appropriate solution wherever the costly option of underground drainage is not feasible. In this sense, there is a need to offer more options to households that desires sanitation facilities which, while being based on the "twin-pit-pour-flush" model, is in keeping their needs and capacity to invest. Low cost sanitation is best propagated as a part and parcel of the maintenance of environmental health."

"Technologies for treatment of sewage are another area of concern. The conventional technologies require electricity, which has to be paid for. On the other hand, low cost technologies like ponds require large area of land that is not readily available in big towns and cities. There is a need to adopt intermediate technologies, of which there is a choice. Further research and development need to be done in this area."

7.62 As regards rest of CMA, while issuing Planning Permission for constructions of buildings, for sewage disposal from households septic tanks are insisted. In cases of larger developments such as special buildings (flats) and group housing upto 75 dwellings in a site septic tank with upflow filters are insisted with a condition that the upflow water shall be used for gardening purposes within the development site. For very large developments exceeding 75 dwelling units and multi-storeyed buildings, in-situ sewage treatment plants (STP) are required to be provided and the treated water shall be used within the developed site for gardening purposes. This method of sanitation is followed for maintenance of environmental health in the rest of CMA areas where sewerage is not available.

Proposal along I.T. Corridor

7.63 Tamil Nadu Government have declared the area along the Rajiv Gandhi Salai (OMR) as I.T. Corridor. CWSSB has made a study for provision of water supply and sewerage system in the I.T. Corridor and assessed the initial demand for water supply as 15 MLD and the projected future demand as 50 MLD.

7.64 The water supply for the I.T., I.T.E.S. industries and other urban developments in the IT Corridor is proposed to be made in two phases. The First Phase includes tapping 20 MLD of water from Palar river at Vayalur by constructing a collector well at Vayalur and treating the same in a water treatment plant to be constructed nearby with a capacity of 20 MLD. An under-ground tank for storing the treated water with a capacity of 5 million litres, and to pump the water up to Pallipattu with an intermediate pumping at Thiruporur making supplies along the IT Corridor. Water will be supplied to the bulk consumers along the IT corridor and balance water will be conveyed to Pallipattu head works for City water supply. Tentative cost of the project is Rs.46.00 crores.

7.65 In Phase-II, when additional demands come up, it is proposed to construct a desalination plant of 50 MLD capacity at Kelambakkam where 58.75 hectares of land belonging to Salt Corporation has been identified.

Providing Underground Sewerage System

7.66 The sewerage system is proposed to be provided at an estimated cost of Rs.26 crores along IT Corridor. CMWSSB has estimated that sewage generated for the present is 27.12 MLD. The urbanised areas in Okkiam Thoraipakkam, Ekattur, Kazhipathur, Padur, Kelambakkam, Thiruporur, Navalur, Semmenchery, Sholinganallur and Karapakkam are proposed to be provided with a separate collection, conveyance, and treatment and disposal system. From Kottivakkam and Perungudi pumping stations the sewage is to be conveyed to the existing Perungudi STP. It is proposed to provide this sewerage system to the present water supply level and expand the treatment plant capacity in modular form when the supply level increases. The collection and conveyance system will also be expanded as and when supply level increases.

7.67 It is proposed to construct 22 nos. of sewerage pumping stations and 5 nos. of STPs for localised treatment and conveyance of treated effluent. The IT, ITES and educational institutions in the corridor will be encouraged to recycle and reuse waste water generated in their complexes for toilets washing and gardening etc.

Annexure VII A

Water Level & Water Quality in TDS in Chennai City and Chennai Metropolitan Area			
City			
Sl.No.	Name of Village	Water level Range (m)	TDS Range (in ppm)
1	Tondiarpet	4.00-6.00	750-1050
2	Royapuram	4.50-6.50	800-2100
3	Perambur	5.00-12.00	700-1100
4	Villivakkam	4.50-10.50	600-830
5	Anna Nagar	7.00-10.00	500-750
6	T. Nagar	6.60-10.50	800-1200
7	Guindy	4.00-8.50	500-700
8	Velachery	3.00-9.00	900-2500
9	Saidapet	5.00-13.00	600-800
10	Adyar	4.00-9.00	800-1700
11	Kolathur	1.00-7.50	600-1200
12	Kotturpuram	1.50-8.00	1000-2800
13	Kodambakkam	5.00-11.50	500-1700
14	Triplicane	4.00-10.00	800-1600
15	Thiruvanmiyur	4.50-10.00	800-2800
16	Kilpauk	2.50-8.00	600-1200
17	Sembium	4.60-8.50	500-1500
18	Egmore	2.50-6.00	450-600
19	Taramani	1.50-10.00	1200-2800
Ponneri Taluk			
20	Manali	2.00-5.00	400-2000
21	Vichur	3.00-5.50	500-1800
22	Athipattu	3.00-6.50	600-1700
23	Athur	3.50-10.00	500-900
24	Nayar	4.25-9.50	450-1100
25	Seekanjeri	2.50-4.50	300-600
26	Nandhiyambakkam	2.00-4.00	400-1000
27	Minjur	2.50-6.50	700-1500
28	Sholavaram	1.50-7.00	400-1400
29	Ennore	3.00-6.00	500-1700
30	Alamadi	3.50-6.00	400-900

Ambattur Taluk			
31	Pondeswaram	3.00-10.00	400-850
32	Naravarikuppam	2.00-9.00	500-950
33	Athipattu	3.00-8.00	800-1900
34	Padi	2.50-7.50	500-1050
35	Korattur	3.00-9.00	700-1800
36	Mogappair	4.30-8.00	300-695
37	Madavaram	2.00-7.00	200-900
38	Puzhal	1.00-6.50	350-1300
39	Thiruvottiyur	4.25-6.25	600-1100
40	Maduravoyal	4.00-12.00	600-1200
	Mathur	2.00-7.00	200-900
Thiruvallur Taluk			
42	Pakkam	3.50-9.00	400-110
Poonamallee Taluk			
43	Avadi	2.00-11.00	400-800
44	Thirunindravur	1.50-11.50	300-700
45	Thiruverkadu	1.50-10.50	350-800
46	Pattabiram	2.50-9.00	400-1100
47	Ramavaram	1.50-10.00	300-800
48	Chembarambakkam	0.50-10.00	200-500
Sriperumbudur Taluk			
49	Chettipedu	2.00-9.00	300-750
50	Nandambakkam	2.00-10.00	450-1050
51	Meppur	2.50-9.50	400-900
52	Mangadu	3.00-10.00	400-900
53	Kundrathur	2.50-7.50	300-900
Tambaram Taluk			
54	Nanganallur	3.00-8.00	800-1400
55	Thiruneermalai	3.00-8.00	450-1050
56	Pallikaranai	1.50-7.00	700-1600
57	Tambaram	1.50-8.00	300-800
58	Sholinganallur	2.00-7.50	250-650
59	Shithalapakkam	3.00-6.50	400-900
60	Pallavaram	3.50-7.75	450-650
61	Chrompet	3.00-7.00	500-900

62	Meenambakkam	3.00-8.00	800-1400
63	Perungudi	2.50-9.50	1100-2500
64	Nanmangalam	2.00-8.00	300-900
65	Kovilambakkam	1.50-7.00	250-800
66	Chitlapakkam	2.50-8.00	400-900
67	Pammal	2.00-7.50	350-800
68	Nandambakkam	2.50-7.00	300-750
69	Madambakkam	2.00-6.50	250-650
Chengalpattu Taluk			
70	Vandalur	2.50-7.50	400-900
71	Mannivakkam	2.00-8.00	350-800