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Technical Report Series

DISTRICT GROUNDWATER BROCHURE
CHENNAI DISTRICT
TAMIL NADU

By

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Government of India
Ministry of Water Resources

Central Ground Water Board

South Eastern Coastal Region
Chennai
November 2008

DISTRICT AT A GLANCE (CHENNAI DISTRICT)

S. No.	ITEMS	STATISTICS	
1.	**GENERAL INFORMATION**		
	i. Geographical area (Sq. km)	174	
	ii. Administrative Divisions (As on 31-3-2007) Number of Taluks Corporation	 5 1	
	iii. Population (As on 2001 Census) Total Population Male Female	 4343645 2219539 2124106	
	iv. Average Annual Rainfall (mm)	1200	
2.	**GEOMORPHOLOGY**		
	i. Major physiographic Units	1. Fluvial land forms 2. Marine land forms 3. Erosional land forms	
	ii. Major Drainages	.	
3.	**LAND USE (Sq. km) (2005-06)**	Adyar & Cooum	
	i. Forest area ii. Net area sown iii. Cultivable area	3 - -	
4.	**MAJOR SOIL TYPES**	Beach sands, Clay & alluvial soils	
5.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 01.05.2008)**		
	i. Dug wells	11	
	ii. Piezometers	3	
6.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium, sandstones (argillaceous), clay, shale, silt stone, granites, gneisses and charnockite	
7.	**HYDROGEOLOGY**		
	i. Major water bearing formations	Sand, sandstone, weathered and fractured granites, gneisses and Charnockite	
	ii. Pre monsoon depth to water level (May 2006)	2.21–7.64 m bgl	
	iii. Post monsoon depth to water level (Jan. 2007)	0.45-5.32 m bgl	
	iv. Long term water level trend in 10 years (1998-2007) (m/yr)	**Annual**	
		Rise	**Fall**
		Min: 0.003 Max: 0.93	Min:0. 04 Max:0. 78

8.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)**	
	i. Number of Exploratory wells ii. Number of Observation wells iii. Number of Piezometers under Hydrology Project-I	5 3 3
	iv. Depth range (m bgl)	39–225
	v. Discharge (lps)	1–25
	vi. Storativity (S)	2.9×10^{-4} to 4.5×10^{-3}
	vii. Transmissivity (m^2/day)	6.00–872
9.	**GROUND WATER QUALITY (As on MAY 2006)**	
	i. Presence of chemical constituents more than permissible limit	TH as $CaCO_3$, NO_3 and Fe
	ii. Type of water	NaCl, Ca-HCo_3
10.	**AWARENESS AND TRAINING ACTIVITY**	
	i. Mass Awareness Programs Organized	
	Year	1998-99
	Place	Chennai
	No. of Participants	200
	ii. Water Management Training Organized	
	Year	1998-99 & 12004 - 05
	Place	Besant Nagar, Chennai
	No. of Participants	28
11.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Technical Guidance were provided as when sought
	i. Projects completed by CGWB Number of structures Amount spent	i. 2 (Percolation Ponds) in CLRI Rs. 7.51 lakhs ii. Rooftop rainwater harvesting in SG & SWRDC, Taramani Rs. 7.6 lakhs
	ii. Projects under technical guidance of CGWB Number of structures	Nil
12.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	1. Insitu salinity in Mandhaveli, Anna nagar, Indira nagar, Velacheri, and Taramani areas. 2. Higher concentration of Iron in ground water in K.K. Nagar, Anna Nagar, Valasaravakkam, R. A. Puram areas. 3. Contamination of ground water all along the Buckingham Canal within the city. 4. Over exploitation of ground water has resulted in change in quality of ground water in Besant Nagar area- Sea water ingress.

1.0. INTRODUCTION

1.1 Administrative Details

Chennai district (Plate-I) is having administrative divisions of 5 taluks and 1 corporation. Chennai Corporation is divided into 155 administrative divisions (Table-1).

Table-1. Administrative Divisions

S. No.	Taluk	No. of Divisions
1	Purasavalkam, Perambur	31 (32 – 63)
2	Fort-Tondiarpet	31 (1 – 31)
3	Mambalam-Guindy	11 (130 – 141)
4	Mylapore-Triplicane	30 (79 – 96) & (142-155)
5	Egmore-Nungambakkam	46 (64 –78) & (97-129)

(Source: Assistant Director of Statistics, Chennai)

1.2 Basin and sub-basin

Chennai district falls in part of Korattalaiyar-Arniyar River basin.

1.3 Drainage

Adyar River originates at the confluence (Thiruneermalai) of two streams that drains the upstream area of Chembarambakkam tank. It is a small river of 42 km length and a catchment of 800 Sq. km. The river carries flow all through 365 days of a year with an average discharge of 89.43 MCM/Year at Kattipara cause way. It drains the southern part of the district and remains flooded during monsoon. During the high tides, the backwaters from the Bay of Bengal enter inland up to 3 – 4 km.

Cooum is the other main river flowing through the central part of the district and carries only drainage water, which is highly polluted. It originates from the surplus waters from the Cooum tank in Tiruvallore taluk and the tanks, which are in enroute, discharge their surplus water into the river during flood season. The flow of Cooum River at Korattur is 40.2 MCM/year for an average duration of 31 days in a year.

Otteri Nulla is another small stream flowing in the northern part of the city. Buckingham canal is the man made one for navigation purposes earlier, but now it act as sewerage carrier in the city.

1.4 Studies/Activities carried out by CGWB

Central Ground Water Board had taken up exploration in Gondwana sediments of

Chennai and its environs during their annual work programme of 1992-93. Central Ground Water Board has taken up number of consultancy works during the year 1989-92 and collected extensive data on sub-surface lithology and quality of water as well as characteristics in different parts of Chennai city.

The Central Ground Water Board has taken up ground water regime monitoring in Chennai district. There are 14 ground water monitoring wells and are monitored since 1986. Water samples are collected during May to study the changes in water quality with time and space.

2.0. RAINFALLS AND CLIMATE

The northeast monsoon during the month of October, November and December chiefly contributes the rainfall for the district. Most of the precipitation occurs in the form of one or two cyclones caused due to depressions in Bay of Bengal. The southwest monsoon rainfall is highly erratic and summer rains are negligible. The average annual rainfall of the district is 1200 mm (1978-2008).

Chennai district enjoys a tropical climate with mean annual temperature of 24.3 to 32.9° C. The temperature is usually in the range of 13.9 to 45° C.

The humidity is usually in the range of 65 to 84% and sea breeze in the evening hours is a blessing to combat the high temperature and humidity during summer months.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

Chennai district forms part of coastal plains of Tamil Nadu. Major part of the district is having flat topography with very gentle slope towards east. The altitudes of land surface vary from 10 m above MSL in the west to sea level in the east. Fluvial, marine and erosional landforms are noticed in the district. Marine transgression and regressions and neo-tectonic activity during the recent past have influenced the morphology and resulted in various present landforms.

Meandering streams with small sand bars are present along the course of Adyar River. The pediment and buried pediment in Guindy area in and around the reserved forest, is the only area where the ecological system is less disturbed, while the other areas are completely disturbed by built up area with large-scale human interference and pollution.

Marina beach is the most natural beach in the world with a width varying from 150 to 600 m and a length of 5.6 km, also encroached by human activity. Theosophical society, located on the banks of Adayar river mouth is the only area with well-preserved natural coastal morphology, sand dunes, beach ridges, flora etc.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Chennai district is underlain by various geological formations from ancient Archaean to the Recent Alluvium. The geological formations of the district can be grouped into three units, namely i) the Archaean crystalline rocks ii) consolidated Gondwana and Tertiary sediments and iii) the Recent Alluvium. The Archaean crystalline rocks of the district comprise chiefly of charnockites, gneisses and the associated basic and ultra basic intrusives. A map showing the hydrogeology of the district is given as Plate–II.

The crystalline rocks are weathered and jointed/fractured. The degree and depth of weathering varies from place to place and the thickness of weathered mantle varies from less than a metre to about 12 m in this district. The successful bore wells drilled tapping the deeper fractured aquifers in Saidapet, Adyar, Kasturba nagar, Gandhi nagar and Ashok nagar revealed the existence of fracturing down to depth of 60 m below ground level.

The Gondwana shale is black to dark grey in colour and is jointed/fractured. They are encountered in a number of boreholes and their thickness varies from 24 m in Kilpauk area through 20 m in Ashok Nagar area to more than 130 m in Koyambedu area.

The occurrence of Tertiaries in Chennai district is not well demarcated. However, the sandstones encountered in some of the boreholes below alluvium in Binny Road, Poes Garden, Anna Nagar and Rayapuram areas, which belong to Tertiary group. The granular zones below the Kankar layer in the depth range of 20-28 m bgl in Poes Garden probably represent Tertiary sandstones and tube wells tapping these granular zones yield 2 to 3 lps.

Ground water in Chennai district occurs in all the geological formations viz., the Archaean crystallines, Gondwanas, Tertiaries and alluvium and is developed by means of ring wells, dug wells, filter point wells, bore wells and tube wells. The yield and depth range of aquifers is given in Table-2.

Table-2.Yield and depth range of aquifers

Formation	Type of well	Depth range (m bgl)	Yield (lps)
Alluvium	Tube well	10-30	1-12
	Dug well	6-11	0.058-1.16
Sandstone	Tube well	20-28	2-3
Gondwana	Tube well	20-60	1-3
Crystalline	Bore well	10-15	Up to 4

The alluvium covers the major part of the district. The alluvium consists of sand, silts and clays. The thickness of alluvium varies from place to place and a maximum of 28 m is encountered in north Chennai near Perambur. Kilpauk water works area has 24 m thick alluvium.

The yield of the wells at Kilpauk and Tirumangalam tapping the productive granular zones met within the alluvium is 25 lps and 6 lps for a drawdown of 7.21 and 0.22 m with a specific capacity of 206.35 and 40 lpm/m of drawdown respectively.

The yield of four bore wells tapping the productive granular zones met within the Gondwana sediments were found to range from less than 1 to 4 lps for drawdowns varying between 8 to 9 m. The specific capacity ranged from 8 to 32 lpm/m of drawdown.

In Velacherry area there is a sheet of black clay over crystalline rocks. The open wells located in Velacherry area are giving moderate yield and the yield of wells varies from 2 to 10 m^3/day depending on the diameter, topography and thickness of weathering. Many wells are dry in summer months due to limited thickness of productive zones or over development. There are a few fractures developed in the crystalline rocks and select bore wells hence encountered such fractures down to 90 m. The yields of these bore wells are as high as 4 lps at select sites. There are no indications of any prominent lineaments. There are number of bore wells in the city piercing the top 10 to 15 m thick alluvial cover and penetrate the crystalline rocks. The failure of many bore wells in Velacherry area may be due to absence of potential fracture down to 60 m bgl.

During May 2006, the depth to water levels in observation wells tapping shallow aquifer ranged from 2.21 to 7.64 m bgl. Shallow ground water levels i.e., less than 5 m bgl were prominently observed in observation well at Alwarpet, Besant Nagar, K.K. Nagar, Tondiarpet and Velacherry. Water levels >5 m bgl and <10 m bgl were observed in observation wells at Aminjikarai, T. Nagar, Tirumangalam and Vepery. A map showing the depth to water level during pre monsoon (May 2006) is given as Plate – III.

Depth to ground water levels during post monsoon (January 2007) varies between 0.45 and 5.32 m bgl. The water levels <2.00 m bgl in isolated pockets at K.K. Nagar, Villivakkam and Velacherry. Water levels 2-5 m bgl were observed in observation well at Aminjikarai, T. Nagar, Thirumangalam, Tondiarpet, Vallalar Nagar, Vepery and CLRI. A map showing the depth to water level during post monsoon (January 2007) is given as Plate – IV.

4.1.1 Long-term Fluctuation

The long-term water level fluctuation for the period from 1998 to 2007 indicates rise in water level in the area at the rate of 0.003 0 0.93 m/year. The fall in water level ranges between 0.037 and 0.798 m/year.

4.1.2 Aquifer Parameters

The yield of the exploratory wells drilled in Chennai district ranged from 1 to 25 lps. The computed Transmissivity is varies between 6.00 and 872 m^2/day and the Storativity varied between 2.9×10^{-4} and 4.5×10^{-3}.

4.2 Ground Water Quality

Ground water in phreatic aquifers in Chennai city in general is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone (in Micro Siemens at 25° C) during May 2006 was in the range of 475 to 9350 in the district. It is observed that in most of the samples EC falls above 2250 Micro Siemens at 25° C. Conductance below 750 µS/cm have been observed in only one sample in Besant Nagar.

It is observed that the ground water is suitable for drinking and domestic uses in respect of all the constituents expect total hardness and Nitrate. Total Hardness as $CaCO_3$ is observed to be in the excess of permissible limits in about 55 percent of samples analysed whereas Nitrate is found in excess of 45 mg/l in about 10 percent samples. The incidence of high total hardness is attributed to the composition of litho units constituting the aquifers in the district, whereas the Nitrate pollution is most likely due to improper disposal of waste.

4.2.1. Status of ground water development

Ground water development is related to the water supply position. The relation between water supply and ground water development makes it difficult to quantify or generalize the ground water extraction. The ground water is developed through dug wells in alluvial areas, tube wells and bore well in area characterised by sedimentary and crystalline rocks respectively. In general, the depths of dug wells varied from 10 to 15 m bgl while the tube well and bore wells are in the depth range of 60-100 m bgl. The tube wells / bore wells in general can sustain a pumping of 6 –10 hrs in a days while dug wells can sustain for 2-4 hrs a day.

5.0 GROUNDWATER MANAGEMENT STRATEGY

The dug wells, filter point wells, tube wells and bore wells are the most common abstraction structures in the district. The dug wells are constructed in the alluvium as well as in hard rock areas in the city. The depth of the wells generally ranges between 10 and 15 m bgl and as shallow as 4 m bgl in Marina beach and the masonry structures are common. Some of the wells in coastal tract are tapping beach sands and are brick lined with cement plastering on the top 6 m. The deepening of structures with small diameter ring well inside the open well is commonly practiced.

5.1. Suitable well design

The following well designs are recommended for the Chennai city area (i) infiltration well with horizontal and extension bores (ii) shallow tube well (Hand auger) (iii) shallow/medium tube well (Rotary rig) and (iv) deep bore well. Infiltration wells of 4.5 m diameter and of 6 to 7 m bgl depth in beach aquifers of Besant Nagar are likely to give 416 to 4166.6 lph. Shallow tube wells of 100 /125 mm diameter and of 10 to 20 m bgl

depth are likely to yield 1000 lph and shallow/medium tube wells with proper gravel packing will give 1000-30,000 lph. The deep bore wells of 45-60 m bgl depth are likely to give 1000 to 45,000 lph. The map showing the development prospects for the district is shown in Plate-VI.

5.2. Water Conservation and Artificial Recharge

CGWB has rendered technical assistance to local residents and a few Central Government Organizations in implementing Rainwater harvesting. In addition to this it has also given financial assistance for construction of percolation ponds (2 Nos.) with recharge shafts and dug well recharge in CLRI under Central Sector Scheme An amount of Rs.7.51 lakhs have been funded.

Rooftop rainwater harvesting in State Ground & Surface Water Resources Data Center, Taramani has been implemented for an amount of Rs. 7.6 lakhs funded by Ministry of Water Resources, Government of India under Fresh Water Year.

The Government of Tamil Nadu, has made it mandatory that all buildings in Tamil Nadu should have provision for roof top rainwater harvesting. Details of rainwater harvesting carried out in Chennai city are given Table-3.

Table-3. Details of rainwater harvesting carried out in Chennai city

Sl. No.	Total No. of buildings		Building covered with Rainwater harvesting as on 26.06.03	% of coverage
1	Residential	291464	276401	94.83
2	Commercial	26064	21846	83.83
3	Institutional	1454	1179	81.08
4	Government	2999	2680	89.36
	Total	**321978**	**300519**	**93.34**

(Source: Chennai Metropolitan Water Supply and Sewerage Board)

6.0. GROUNDWATER RELATED ISSUES & PROBLEMS

1. Insitu salinity in Mandhaveli, Annanagar, Indira nagar, Velacheri, and Taramani areas.
2. Higher concentration of Iron in ground water in K.K. Nagar, Anna Nagar, Valasaravakkam, R. A. Puram areas.
3. Contamination of ground water all along the Buckingham Canal within the city.
4. Over exploitation of ground water has resulted in change in quality of ground water in Besant Nagar area.

7.0 Awareness & Training Activity

7.1 Mass Awareness Campaign (MAP) & Water Management Training Programme (WMTP) by CGWB

One mass awareness program was organized in Chennai during the year 1988-99 and about 200 persons from different sectors participated.

One water management Training was conducted in Chennai during the year 1988-99 and about 28 persons from different institutions including Universities attended the training.

Second training on water management was conducted during 2005 at Chennai about 21 personnel from various central and state agencies attended the training

7.2 Participation in Exhibition, Mela, Fair Etc.

Participated in the inter school science exhibition organized by Tamil Nadu science and Technology Centre, Chennai from 27.11.03-30.11.06.

7.3. Presentation & Lectures delivered in Public Forum/Radio/TV/Institution of Repute/Grass roots association/NGO/Academic Institutions etc

8.0 AREA NOTIFIED BY CGWA/SGWA

Government of Tamil Nadu has banned extraction of ground water for commercial purposes in Chennai district.

9.0. RECOMMENDATIONS

To meet the increased demand in future, recycling of industrial wastewater has to be planned and implemented. A centralised system of collecting effluents of treatment plants for recycling of water can be prepared separately for Adyar River, Cooum river, Buckingham canal system. Lining of vulnerable sections will reduce ground water pollution by influent seepage of bad water as well as polluted effluents.

Two pipe lines systems Viz. one line for drinking water supply and the other for recycled water for other uses can be initiated on experimental basis at select places and can be implemented on the success of the initiative.

The local development of ground water should be on scientific lines. There are already indications of movement of interface in the coastal belt in Besant Nagar, Tiruvanmiyur etc. This has to be closely monitored by periodical hydrochemical sampling, as otherwise the damage once sets in can never be reversed.

The conventional drilling techniques should be improved and the failure of wells due to wrong designing has to be avoided. The failure of open wells due to choking of weep holes can be avoided by cleaning the well with Sodium Polyphosphate (Sodium Hexa Meta Phosphate) and adding horizontal filter points. The heavy drawdown created by high capacity pump should be avoided in the coastal area and safe yield of any abstraction structures and suitable pump has to be decided on scientific pumping test of wells. Improved design of ring wells with slotted copper mesh windows can be used.

Studies on pollution to ground water are to be taken up urgently and suitable follow up measures are to be adopted to protect the environment and prevent problems in future.

PLATE - I

CENTRAL GROUND WATER BOARD, SECR, CHENNAI

CHENNAI DISTRICT, TAMIL NADU

LOCATION

(NOT TO SCALE)

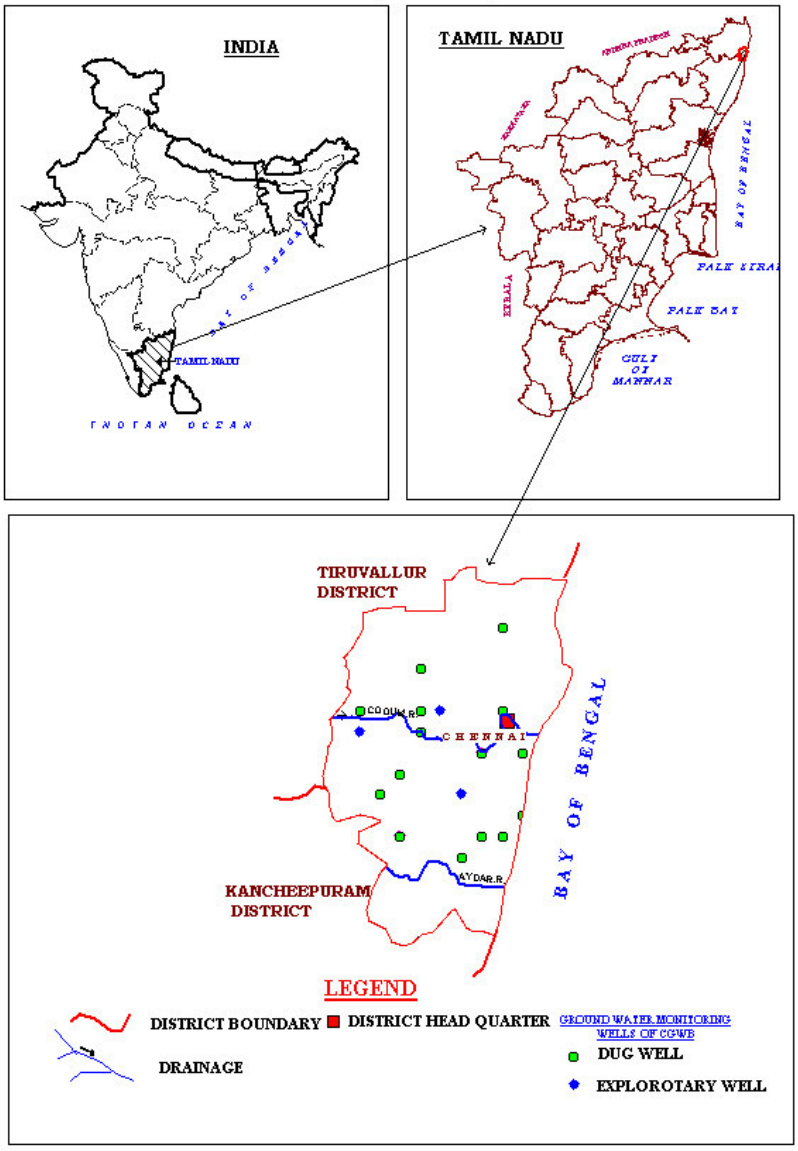
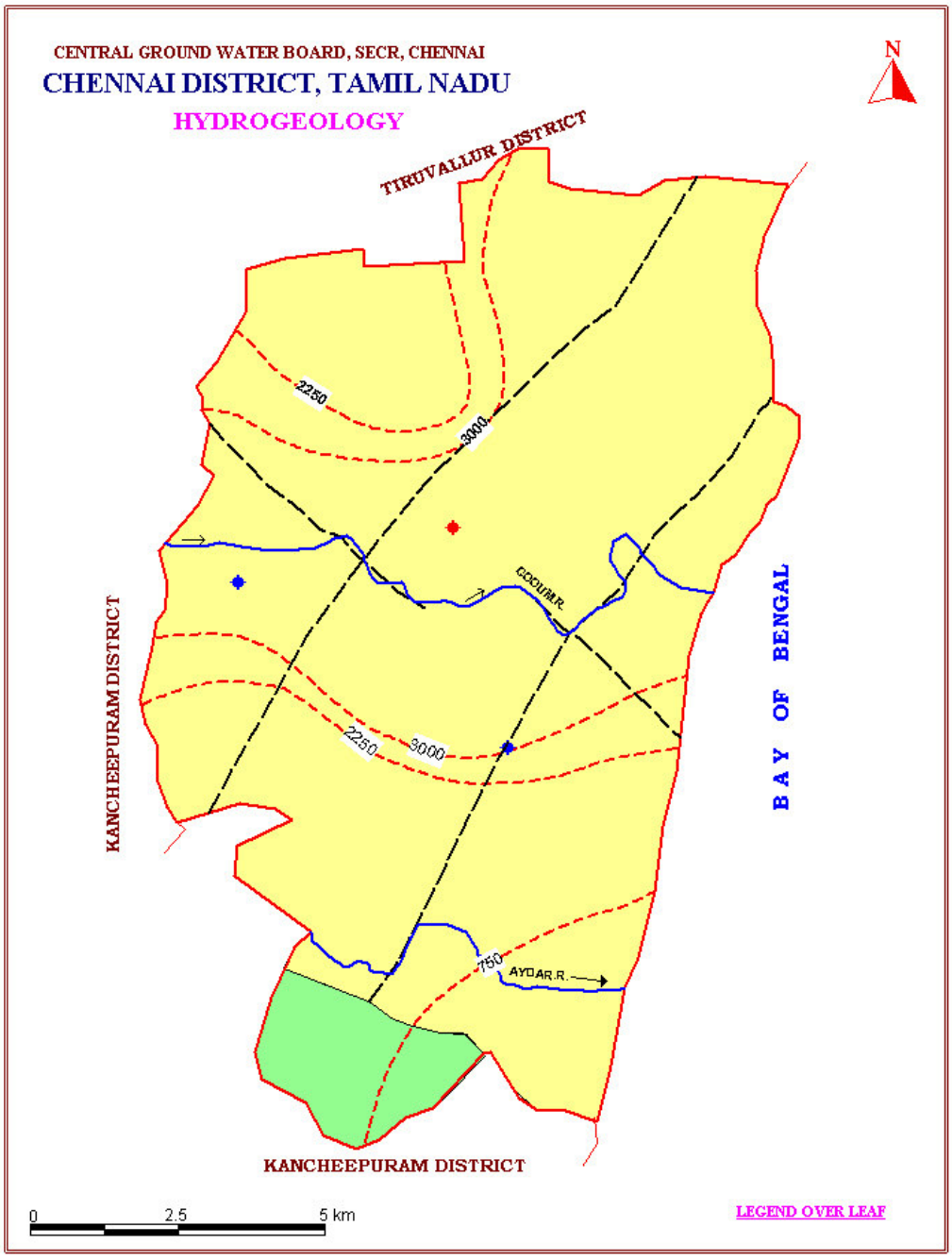


PLATE - II


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
CHENNAI DISTRICT, TAMIL NADU
HYDROGEOLOGY
N
TIRUVALLUR DISTRICT
2250
3000
COOUM R.
KANCHEEPURAM DISTRICT
2250
3000
BAY OF BENGAL
750
AYDAR R.
KANCHEEPURAM DISTRICT
0
2.5
5 km
LEGEND OVER LEAF

LEGEND FOR PLATE -II

ADMINISTRATIVE SETUP

DISTRICT BOUNDARY

RIVER

GROUND WATER HYDROLOGY

EXPLORATORY BORE WELL [CGWB]

HIGH YIELDING BORE WELL [CGWB]

HYDROCHEMISTRY

750 ISOCONS [Sp ELECTRICAL CONDUCTANCE [µS /Cm at 25° C]

STRUCTURE

TRACE OF LINEAMENT

AQUIFER	AGE	LITHOLOGY	GROUND WATER CONDITIONS	YIELD PROSPECTS (lpm)	GROUND WATER DEVELOPMENT STRATEGIES
UNCONSOLIDATED	SUB-RECENT	RIVER ALLUVIUM, BROWN SANDSTONE, GREY & BLACK SHALE	DISCONTINUOUS THIN UNCONFINED TO CONFINED AQUIFERS	60 - 720	DEVELOPMENT THROUGH SMALL DIAMETER DUG WELLS, SHALLOW & MEDIUM TUBEWELLS
CONSOLIDATED	ARCHAEAN	GRANITES, GNEISSES, CHARNOCKITES	DISCONTINUOUS, UNCONFINED TO SEMI-CONFINED AQUIFERS, RESTRICTED TO WEATHERED RESIDUUM AND FRACTURES	60 - 240	SUITABLE FOR DEVELOPMENT THROUGH DUG WELLS. BOREWELLS FEASIBLE IN FRACTURE ZONES, BEST LOCATIONS BEING INTERSECTION OF FRACTURES

PLATE - III

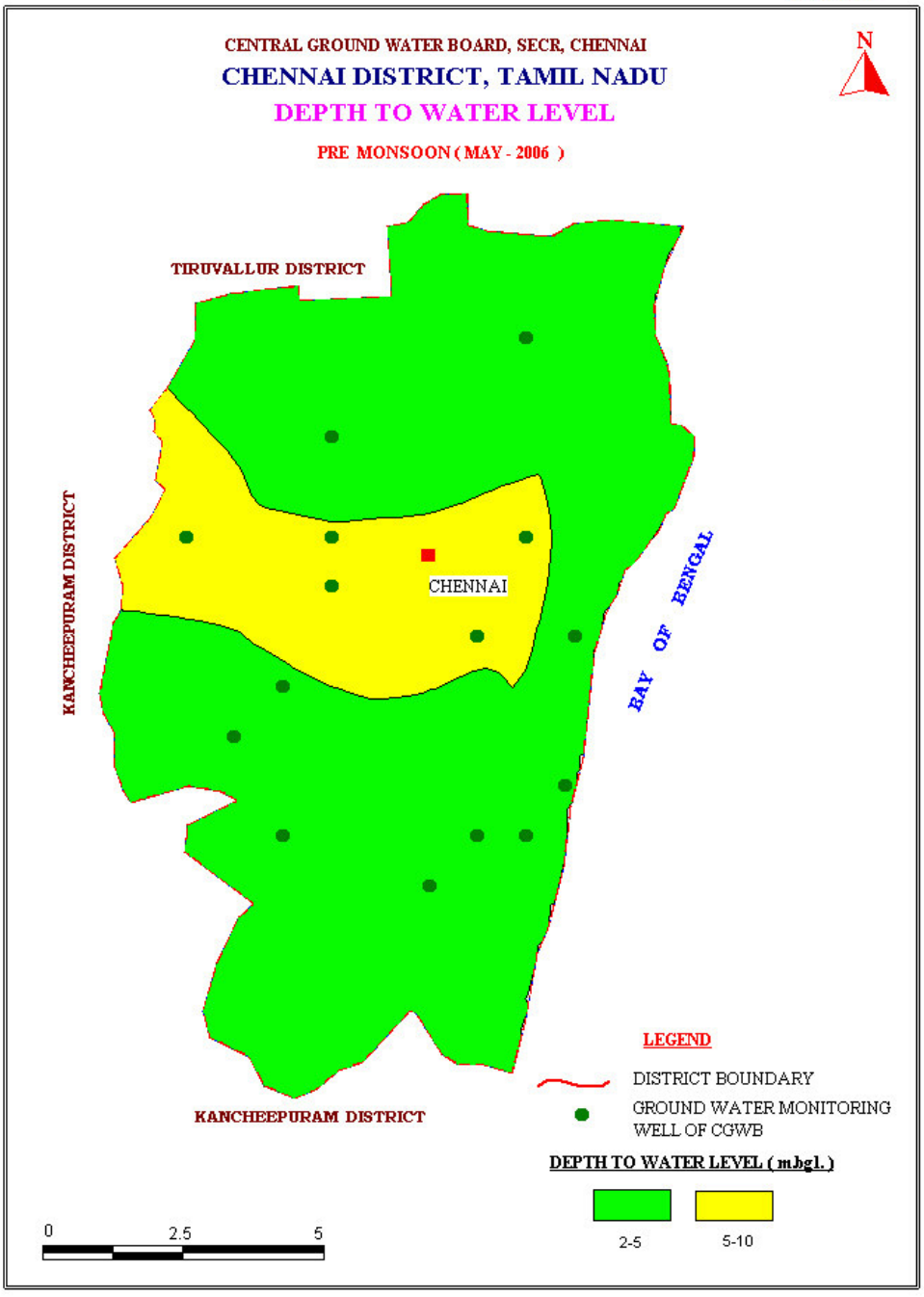

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
CHENNAI DISTRICT, TAMIL NADU
DEPTH TO WATER LEVEL
PRE MONSOON (MAY - 2006)
N
TIRUVALLUR DISTRICT
KANCHEEPURAM DISTRICT
CHENNAI
BAY OF BENGAL
KANCHEEPURAM DISTRICT
LEGEND
DISTRICT BOUNDARY
GROUND WATER MONITORING WELL OF CGWB
DEPTH TO WATER LEVEL (mbgl.)
2-5
5-10
0
2.5
5

PLATE - IV

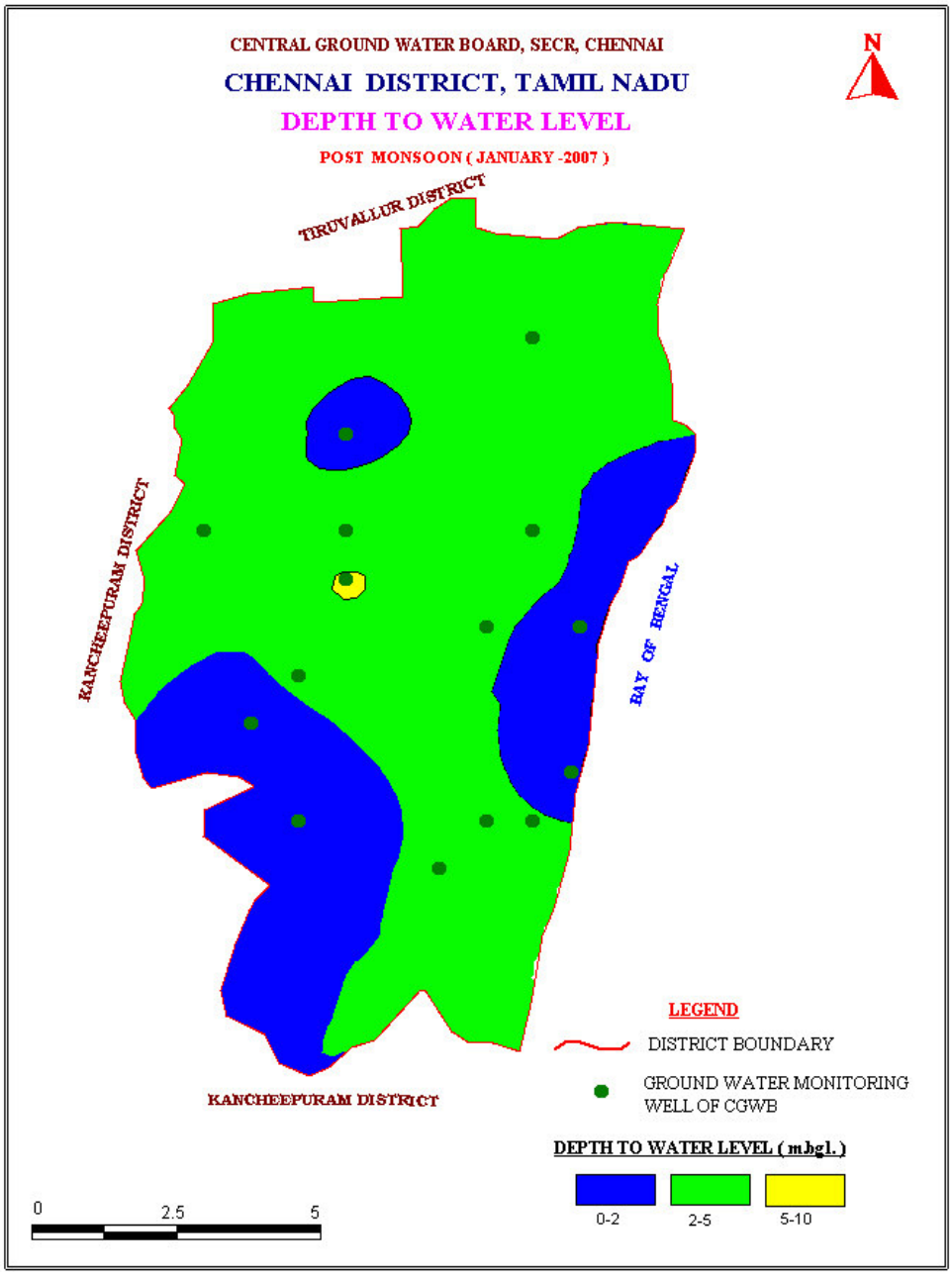

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
CHENNAI DISTRICT, TAMIL NADU
DEPTH TO WATER LEVEL
POST MONSOON (JANUARY -2007)
N
TIRUVALLUR DISTRICT
KANCHEEPURAM DISTRICT
BAY OF BENGAL
KANCHEEPURAM DISTRICT
LEGEND
DISTRICT BOUNDARY
GROUND WATER MONITORING WELL OF CGWB
DEPTH TO WATER LEVEL (mbgl.)
0-2
2-5
5-10
0
2.5
5

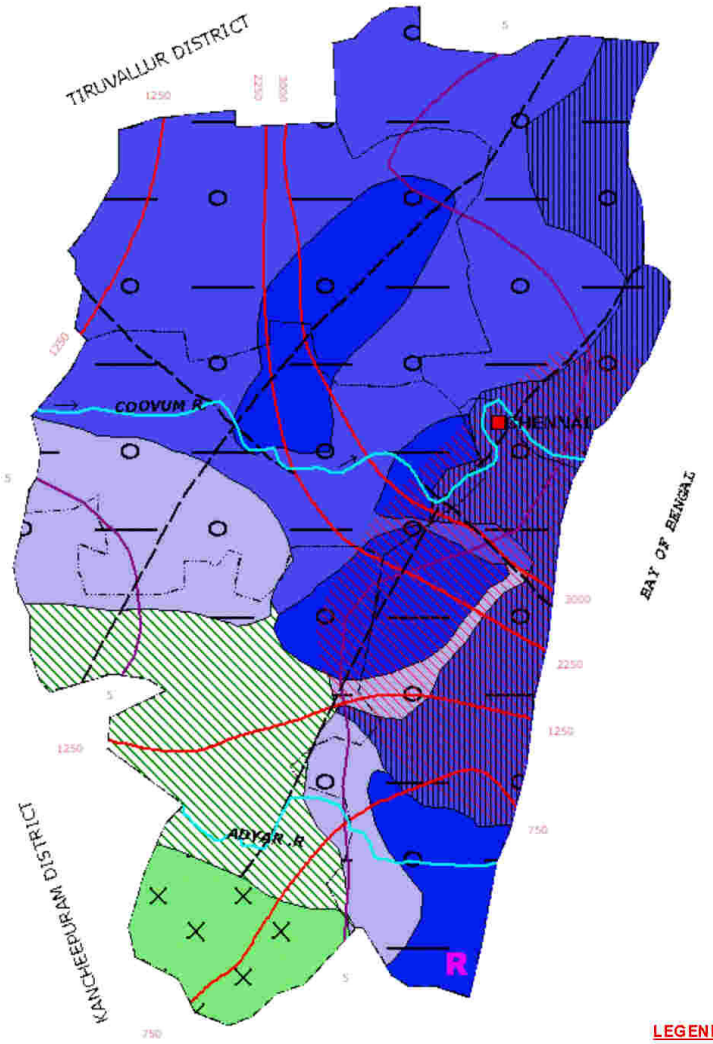
PLATE - V

CENTRAL GROUND WATER BOARD, SECR, CHENNAI.

GROUND WATER DEVELOPMENT POTENTIAL AND ARTIFICAL RECHARGE PROSPECTS

CHENNAI DISTRICT, TAMIL NADU

(NOT TO SCALE)



LEGEND FOR PLATE - V

DISTRICT – CHENNAI

	Wells Feasible	Rigs Suitable	Depth of Well (mbgl)	Discharge (LPM)	Suitable Artificial Recharge Structures
Soft Rock Aquifer	Tube Well Tube Cum Bore Well	Rotary (Calyx) Hand Bore / DTH	20 – 30 45 - 60	10 – 100 10 - 60	Roof Top rainwater Harvesting Recharge Tube Well
Soft Rock Aquifer	Tube Well	Rotary (Calyx) Direct Rotary	20 – 40 100 -150	50 – 100 100 - 200	Roof Top rainwater Harvesting Recharge Tube Well
Soft Rock Aquifer	Dug Well Tube Well	Manual Rotary (Calyx)	10 – 15 10 – 45	100 – 200 60 - 200	Roof Top rainwater Harvesting Recharge Tube Well
Hard Rock Aquifer	Dug Well Bore Well	Manual Down The Hole (DTH)	8 – 12 45 - 60	50 – 100 20 – 50	Recharge Well Roof Top rainwater Collection & Storage in Sump
Thin Sediments/Hard Rock	Bore Well	DTH	40 - 60	10 - 100	Trenches/Recharge Wells/ Roof Water rainwater Harvesting
	District Boundary				
	District Headquarter		1250	EC in micro siemens / cm at 25° C	
5	Water Level-Pre-Monsoon (Decadal Mean 1993-2002) mbgl			Lineament	
	River with flow direction			Nitrate greater than maximum permissible limit (45 mg/l)	
	Fluoride greater than maximum permissible limit (1.5 mg/l)				

OTHER INFORMATION

Geographical Area	174 Sq. Km.
Number of Taluks	5
Major Drainage	Adyar & Cooum
Population (2001)	4343645
Average Annual Rainfall	1200 mm
Annual Range of Temperature	18 – 41°C
Regional Geology	**Soft rocks:** Alluvium, Tertiary/Gondwana Sediments **Hard rocks:** Granites, gneisses,charnockites.

SAVE WATER

AND

CONSERVE WATER

Published by: Regional Director, CGWB, SECR, E-1, Rajaji Bhavan, Besant Nagar, Chennai-90
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