



For official use

Technical Report Series

**DISTRICT GROUNDWATER BROCHURE
NILGIRI DISTRICT , TAMIL NADU**

**A.SUBBURAJ
SCIENTIST-D**

**Government of India
Ministry of Water Resources
Central Ground Water Board
South Eastern Coastal Region
Chennai**

April 2008

DISTRICT AT A GLANCE (NILGIRI DISTRICT)

S.NO	ITEMS	STATISTICS	
1.	GENERAL INFORMATION		
	i. Geographical area (Sq. Km)	2544.85	
	ii. Administrative Divisions AS on (31-3-2007)		
	Number of Tehsils	06	
	Number of Blocks	04	
	Number of Villages	55	
	iii. Population (As on 2001 Censes)		
	Total Population	762141	
	Male Population	378351	
	Female Population	383790	
	iv. Average Annual Rainfall (mm)	1920 (1901 - 1950)	
2.	GEOMORPHOLOGY		
	i. Major physiographic Units	Mountainous district divided in to Nilgiri plateau, Nilgiri - Wayanad Plateau, Sigur plateau and outer slops facing the plain.	
	ii. Major Drainages	Moyar, Sigur, Kethar halla Coonoor, Kundha, Pykkara, and Kateri.	
3.	LAND USE (Sq. Km)		
	i. Forest area	1425.77	
	ii. Net area sown	810.00	
	iii. Cultivable waste	20.18	
4.	MAJOR SOIL TYPES	Lateritic soil, Red sandy soil, Red loam, black soil, Alluvial and Colluvial soil.	
5.	AREA UNDER PRINCIPAL CROPS IN Ha. (AS ON 31.3.2007) 81079	1.Tea - 58563 (72.23%) 2.Veg. &Fruits- 8082 (9.96%) 3.Coffee - 7940 (9.79%) 4.Spices - 4556 (5.62%) 5.Paddy – 1430 (1.76%)	
6.	IRIGATION BY DIFFERENT SOURCES	Number	Area irrigated
	i. Dug wells	770	534
	ii. Tube wells/ Bore wells	Nil	Nil
	iii. Tanks/Ponds	Nil	Nil
	iv. Canals	01	07
	v. Other Sources	NA	209
	vi. Net irrigated area	750	
	vii. Cross irrigated area	750	
7.	NUMBERS OF GROUND WATER MONITORING STATIONWELLS OF CGWB (AS ON 2007)		
	i. No of dug wells	08	

	ii. No of piezometers	Nil	
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium, Colluvium, Laterite, Granites, Dolerites, Quartzite, Charnockites and Gneisses, Schists.	
9.	HYDROGEOLOGY		
	i. Major water bearing formations	Alluvium, Colluvium, Laterite, weathered, fractured and fissured Crystalline rocks.	
	ii. Pre- monsoon depth to water level (2006)	1.20 – 17.06	
	iii. Pre- monsoon depth to water level (2006)	1.28 - 16.60	
	iv. Long term water level trend in 10 years (1997-2006) in m/yr	Rise (m/year)	Fall (m/year)
		Min.-0.1249 Max.-0.2327	Min.-0.0030 Max.-0.1213
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)		
	i. Number of Exploratory wells drilled	Nil	
	ii. Number of Observation wells drilled	Nil	
	iii. Number of Piezometers drilled under Hydrology Project	01	
	iv. Depth range (m)	NA	
	v. Discharge (Litres per second)	NA	
	vi. Storativity (S)	NA	
	vii. Transmissivity (m ² /day)	NA	
11.	GROUND WATER QUALITY		
	i. Presence of chemical constituents more than permissible limit		
	ii. Type of water		
12.	DYNAMIC GROUND WATER RESOURCES (2004) in mcm		
	i. Annual Replenishable Ground Water Resources	116.39	
	ii. Net Annul Ground Water Draft	4.54	
	iii. Projected demand for Domestic and Industrial Uses upto 2025	3.54	
	iv. Stage of Ground Water Development (%)	7.5	

13.	AWARENESS AND TRAINING ACTIVITY	
	i. Mass Awareness Programmes Organized	
	Date	Nil
	Place	Nil
	No of Participants	Nil
	ii. Water Management Training Organized	
	Date	Nil
	Place	Nil
	No of Participants	Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	i. Projects completed by CGWB	Nil
	Number of structures	
	Amount spent	
	ii. Projects under technical guidance of CGWB	Nil
	Number of structures	
15.	GROUND WATER CONTROL AND REGULATION	
	i. Number of OE Blocks	Nil
	ii. Number of Critical Blocks	Nil
	iii. Number of Blocks Notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUS	<p>1) Declining of ground water level and drying of shallow wells.</p> <p>2) Large scale deforestation, rapid and unplanned industrial and agricultural development brought an imbalance in the environment, particularly in climate.</p>

1.0 INTRODUCTION

1.1 Administrative Details

Nilgiri district is divided into 6 taluks. The taluks are further divided into 4 blocks, which further divided into 55 revenue villages.

Administrative Set-up of Nilgiri District						
S.No	Taluk	Area (Sq.km)	No.of Villages	Block	Area (Sq.km)	No.of Villages
1	Udhagamandalam	88002	12	Udhagamandalam	119764	20
2	KJundha	31762	08	Coonoor	22884	08
3	Coonoor	22884	08	Kothagiri	39665	15
4	Kothagiri	39665	15	Gudalur	72172	12
5	Gudalur	50664	08			
6	Pandalur	21508	04			
District Total		254485	55		254485	

(Source: Office of the Assistant Director of Statistics, Nilgiri)

1.2 Basin and sub-basin

The district is falling in part of east flowing Cauvery river basin as per the Irrigation Atlas of India. Moyar, Bhavani, Kethar halla are the important sub basins. The district is further sub divided into number of minor basins.

1.3 Drainage

The Nilgiri district is drained by a number of streams originating from the number of peaks available in the district. Among the major rivers Moyar river flows in an easterly direction and is bordering the northern boundary of the district. Sigur and Pykara are the major streams of Moyar river. Number of minor streams joins this river from north – northwest and south directions.

The Bhavani river originates in Bhavaniar Betta and flows southwest ward and swings southwards. The Khuda river drains southern part of the district which, joins Bhavani river in the south. The Katteri is another minor river, which flows eastwards and joins the Bhavani river.

The river Kethar halla is flowing in the northern direction. Most of the rivers in Nilgiri plateau have been harnessed by drawing them at several points under the Kunda, mukurthi, Pykara, Chalatti, Puzhe and Moyar Hydro- electric schemes.

1.4 Irrigation practices

The nine - fold land use classification for the district is given below (2005 - 2006)

Sl.No	Classification	Hectares
1	Forests	142577
2	Barren & Uncultivable Lands	3375
3	Land put to non agricultural uses	9975
4	Cultivable Waste	2018
5	Permanent Pastures & other grazing lands	5078
6	Groves not included in the area sown	3538
7	Current Fallows	5069
8	Other Fallow Lands	1855
9	Net Area sown	81000
	Total	254485

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

The block wise and source wise net area irrigated in Ha is given below (2005-06).

S.No	Block	Net area irrigated by					Total Net Area irrigated
		Canals	Tanks	Tube wells	Ordinary wells	Other Sources	
1	Coonoor	0.00	0.00	0.00	434.00	68.00	502.00
2	Gudalur	0.00	0.00	0.00	98.00	140.00	238.00
3	Kotagiri	7.00	0.00	0.00	2.00	0.00	9.00
4	Udhagamandalam	0.00	0.00	0.00	0.00	1.00	1.00
District Total		7.00	0.00	0.00	534.00	209.00	750.00

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

The data available indicate that an area of about 750 ha, which is about 0.30 percent of the total geographical area of the district is under irrigated agriculture. Dug wells are the major source of water for irrigation in the district, accounting for about 71.20 percent of the total area irrigated in the district. Other sources and canals accounting for about 27.80 and 0.93 percent respectively. It is observed that the well irrigation is the highest in Coonoor block followed by block Gudalur.

1.5 Studies/Activities carried out by CGWB

The Geological Survey of India carried out Water supply investigations during 1971. Preliminary ground water surveys were taken up by Natarajan (1982) and Varadaraj (1983) of Central Ground Water Board.

Central Ground Water Board is also carrying out systematic Hydrogeological and Ground Water Management studies and ground water monitoring. Central Ground Water Board conducted geophysical investigations for Water supply investigations. In additions, Central Ground Water Board has also carried out a number of short – term water supply investigations in the district for various government agencies.

2.0 RAINFALLS AND CLIMATE

The district receives rainfall both in southwest and northeast monsoons. The southwest monsoon is more active contributing nearly 50 percent in the west and 40 percent in the east. The northeast monsoon is moderate, contributing nearly 40 percent. The precipitation of rainfall gradually decreases towards decreases from west to east. The rains during the winter and summer periods are significant.

Rainfall data from four stations over the period 1901-1950 were utilised and a perusal of the analysis shows that the normal annual rainfall of the district is 1920 mm. It is minimum around ootacamund (1376.20 mm) in the eastern part of the district. It gradually increases towards west and attains a maximum around Gudalur (2269.00 mm)..

The climate of Nilgiri district is temperate and salubrious throughout the year. Mornings in general are more humid than the afternoons, with the humidity exceeding 90%. In the period June to November the afternoon humidity exceeds 85 % on an average. In the rest of the year the afternoons are low, the summer afternoons being the lowest.

High elevation of this district is result in low temperature, which is further lowered by the excessive moisture content of the atmosphere resulting from the exhalation by the vegetation. The day temperature in the district ranges from 22.1°C in summer to 5.1°C in winter. The night temperature touches 0°C in some times. The summer begins early in March, the highest temperature being reached in April and May. Weather cools down progressively from about the middle of June and by January, the mean daily maximum temperature drops to 5.1°C.

3.0 GEOMORPHYLOGY AND SOIL TYPES

3.1 Geomorphology

Nilgiri district is a mountainous district of Tamil Nadu with many hill ranges and broad valleys with slopping towards plain.

The prominent geomorphic units identified in the district through interpretation of Satellite imagery are 1) Structural hills, 2) Ridges, 3) Valley fills, 4) Pediments, 5) Shallow Pediments, 6) Deep Pediments and 7) Hill top valley 8) Erosional plains.

The Nilgiri hills rise abruptly from the plains (300 m. above MSL) to an average elevation of 1370 m. above MSL. Some of the prominent peaks are the Dodda Betta (2632 m), the highest peak in TamilNadu, Kolar (2625 m), Mukurthi (2554 m), Kudikadu (2590.m), and Deva Betta (2552 m), the conical grass covered Der Betta and Bear hill (2531 m) and Nilgiri peak.

3.2 Soils

The soils of Nilgiri district can be broadly classified into 5 major soils types viz., Lateritic soil, Red sandy soil, Red loam, black soil, Alluvial and Colluvial soil. Major

part of the district covered by Lateritic soil. The Red sandy soil and Red loams are occurring as small patches. Block soil is developed in the valleys; where the water logging is also common during the monsoon period. The alluvial and colluvial soils are seen along the Valleys and major river courses respectively.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Nilgiri district is underlain entirely by Archaean Crystalline formations with Recent alluvial and colluvial deposits. The occurrence and movement of ground water are controlled by various factors such as physiography, climate, geology and structural features. Weathered, fissured and fractured crystalline rocks and the Recent alluvial and colluvial formations constitute the important aquifer systems in the district.

The porous formations in the district are represented by alluvium, colluvium. The alluvial deposits comprising sand with admixtures of silt and clay are confined to the major river and stream courses only. It has been reported that the wells tapping river alluvium remain dry during drought years and in the year of less rainfall. The colluvial materials comprising the sands and gravels are seen in the valley portions. Ground water is developed by dug wells and occurs under phreatic conditions. The depth range of these shallow aquifers ranging from 5.00 to 20 m.

The crystalline rocks of gneisses and charnockites represent weathering, fissures and fractures. Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The thickness of the weathered mantle is varying from less than a meter to as much as 20.00 m. The depth of the wells ranged from 5.00 to 15.00 m bgl. The weathered mantle followed by the jointed and fractured rocks constitute the shallow water table aquifer and it occurs in the major part of the district with in the depth of 20 – 25 m in general.

The Specific capacity of large diameter wells tested in crystalline rocks varying from 100 to 200 lpm / m. of draw down. The saturated thickness of the aquifer varies from 2 to 5 m only. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering.

The yield of bore wells drilled down to a depth of 45 to 100 m, by various state agencies mainly for domestic purposes ranged from 60 to 100 lpm.

The depth to water level in the district varied between 1.20 and 17.06 m bgl during pre-monsoon (May 2006) and it varied between 1.28 and 16.60 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level in the range of 0.35 to 3.05 m bgl and fall in the range 0.08 to 0.73 m bgl. The piezometric head is 2.48 m bgl during pre monsoon (May 2006) and 2.94 bgl during post (Jan 2007).

4.1.1 Long Term Fluctuation (1998-2007)

The long-term water level fluctuation for the period 1998-2007 indicates rise in water level in the range of 0.1249- 0.2327m/year. The fall in water level ranging between 0.0030 and 0.1213 m/year.

4.1.2 Aquifer Parameters

The CGWB has not taken up the ground water exploration by drilling in the district so far on scientific lines. Govt of Tamilnadu has drilled few bore wells with depth ranging from 45.00 to 100.00 for drinking water purpose. Potential fracture zones are identified at depths by this drilling. Ground water occurs under semi-confined to confined condition in the deeper fractures.

4.2 Ground Water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground & Surface Water Resources and Development Centre (PWD, WRO, Government of Tamil Nadu) as on 31st March 2004. The salient features of the computations are furnished below.

Computation of Ground Water Resources of Salem District, Tamil Nadu (2004) (in ha.m)									
S.N	Block	Net Ground Water Availability	Irrigation Draft January -04	Existing Gross ground water draft for Domestic & Industrial Water Supply	Allocation for Domestic and Industrial Requirement for next 25 Years	Existing Ground Water Draft	Balance Ground Water Available for Future Development	stage of Ground water Development	Category (As in Jan 2004)
						Jan-04	Jan-04	Jan-04	
1	Coonoor	1839.36	0.00	84.93	87.94	84.93	1751.42	5	Safe
2	Gudalur	6308.76	62.46	98.63	102.13	161.10	6144.16	3	Safe
3	Kotagiri	2826.76	0.00	85.95	89.00	85.95	2737.76	3	Safe
4	Udhagamandalam	664.22	54.27	71.32	73.85	125.59	536.10	19	Safe
District Total		11639.1	116.74	340.83	352.93	457.57	11169.44		

4.3 Ground Water Quality

Ground water in phreatic aquifers in Nilgiri district, is in general colorless, odorless and predominantly alkaline in nature. The specific electrical conductance of ground water in phreatic zone (in Micro Seimens at 25 o C) during May 2006 was in the range of 116 to 700 in the district. In the major part of the district electrical conductivity is below 500 μ S/cm⁻¹.

It is observed that in major part of the district, the ground water is suitable for drinking and domestic uses in respect of all the constituents. All the constituents are within the permissible limit of drinking water limits except nitrate exceeding the limit in 15 percent of the analysed samples.

With regard to irrigation suitability based on specific electrical conductance and sodium Absorption Ratio (SAR), it is observed that groundwater in the phreatic zone

is suitable for irrigation for all soil types. No salinity or alkali hazard is expected when ground water is used for irrigation purposes.

4.4 Status of Ground Water Development

The estimation of groundwater resources for the district has shown that all the 4 blocks are falling under Safe category.

Tamil Nadu Water Supply and Drainage (TWAD) Board is the Government agency responsible for providing drinking water supplies to the urban and rural populace in the district. The water requirements of the habitations are met with either through surface water sources or through various Mini Water Supply Schemes or Integrated water supply schemes utilising the available ground water resources. The status of urban and rural water supply in the district is furnished below

Total Number of Rural Habitants	:	1034
Not Covered	:	1 (0-9 Lpcd)
Partly Covered	:	292 (10-39 Lpcd)
Fully Covered	:	741 (40 Lpcd and above)

The habitants of 4 Municipalities of the district are provided with 40 - 90 Lpcd water and the habitants of 11 town Panchayats are provided with 55 – 70 Lpcd water.

Dug wells have traditionally been the most common ground water abstraction structures used for irrigation in the district, with yields ranging from <50 to 200 m³/day in weathered crystalline rocks and up to 400 m³/day in Recent alluvial formations along major drainage courses.

5.0 GROUNDWATER MANAGEMENT STRATEGY

5.1 Groundwater Development

In view of the comparatively low level of ground water development (7.5 %) of the district more numbers of irrigation wells can be constructed at suitable locations. Proper water management methods must be adopted for further development of available ground water resources in the district.

The development of ground water for irrigation in the district is only through dug wells tapping the weathered residuum or recent alluvial deposits. Dug wells with extension bores wherever necessary is ideal for hard rock areas whereas large diameter dug wells with radials is suitable for alluvial and Colluvial areas. The map showing the development prospects for the district is shown in Plate VI.

5.2 Water Conservation and Artificial Recharge

The topography of Nilgiri district, in general, is suited for construction of various artificial recharge structures such as check dams and sub-surface dykes. The

following criteria have to be analysed for identification of area suitable for implementation of artificial recharge schemes.

- i) Hydrological and hydrogeological data of various aquifer systems.
- ii) Long-term behaviour of ground water levels.
- iii) Rainfall and run-off characteristics.
- iv) Geology and geomorphology.
- v) Lineament pattern & density.
- vi) Drainage characteristics.
- vii) Soils and land-use.
- viii) Slope.

The exact locations of these structures, however, are to be decided on the basis of detailed field investigations

There is considerable scope for implementation of roof – top rainwater harvesting in the district Recharge pits / Shafts / trenches of suitable design are ideal structures for rain water harvesting in such areas. Free technical guidance for implementation of roof-top rain water harvesting schemes is also being provided by Central Ground Water Board.

6.0 GROUNDWATER RELATED ISSUES & PROBLEMS

The trend analysis of historical ground water level data indicates a long-term fall in few locations of the district. Declining ground water levels of shallow wells also noticed in few locations.

There is no ground water Pollution due to industrial effluents in Nilgiri district. Slight industrial pollution of surface and ground water has been noticed at one or two places in the district.

7.0 AWARENESS & TRAINING ACTIVITY

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

Nil

7.2 Participation in Exhibition, Mela, Fair Etc.

Nil

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

Nil

8.0 AREA NOTIFIED BY CGWA/SGWA

Central Ground Water Authority has not notified any area in the district, since all the four blocks are falling in Safe Category.

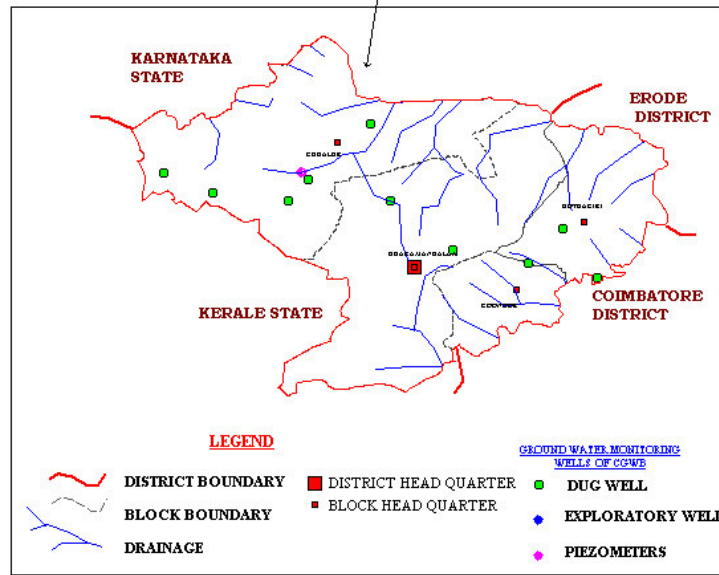
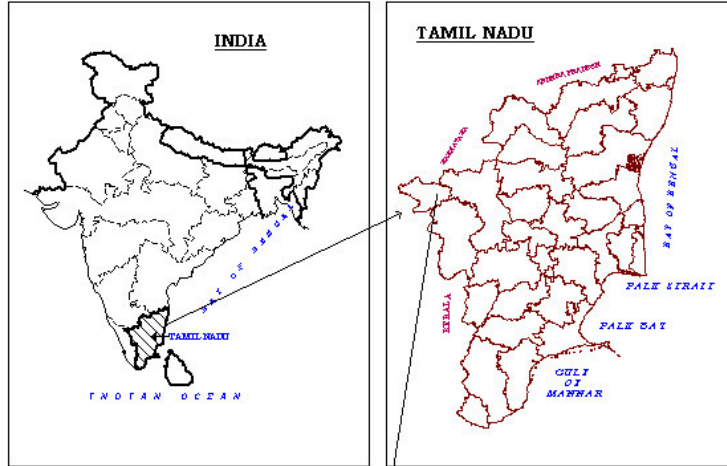
9.0 RECOMMENDATIONS

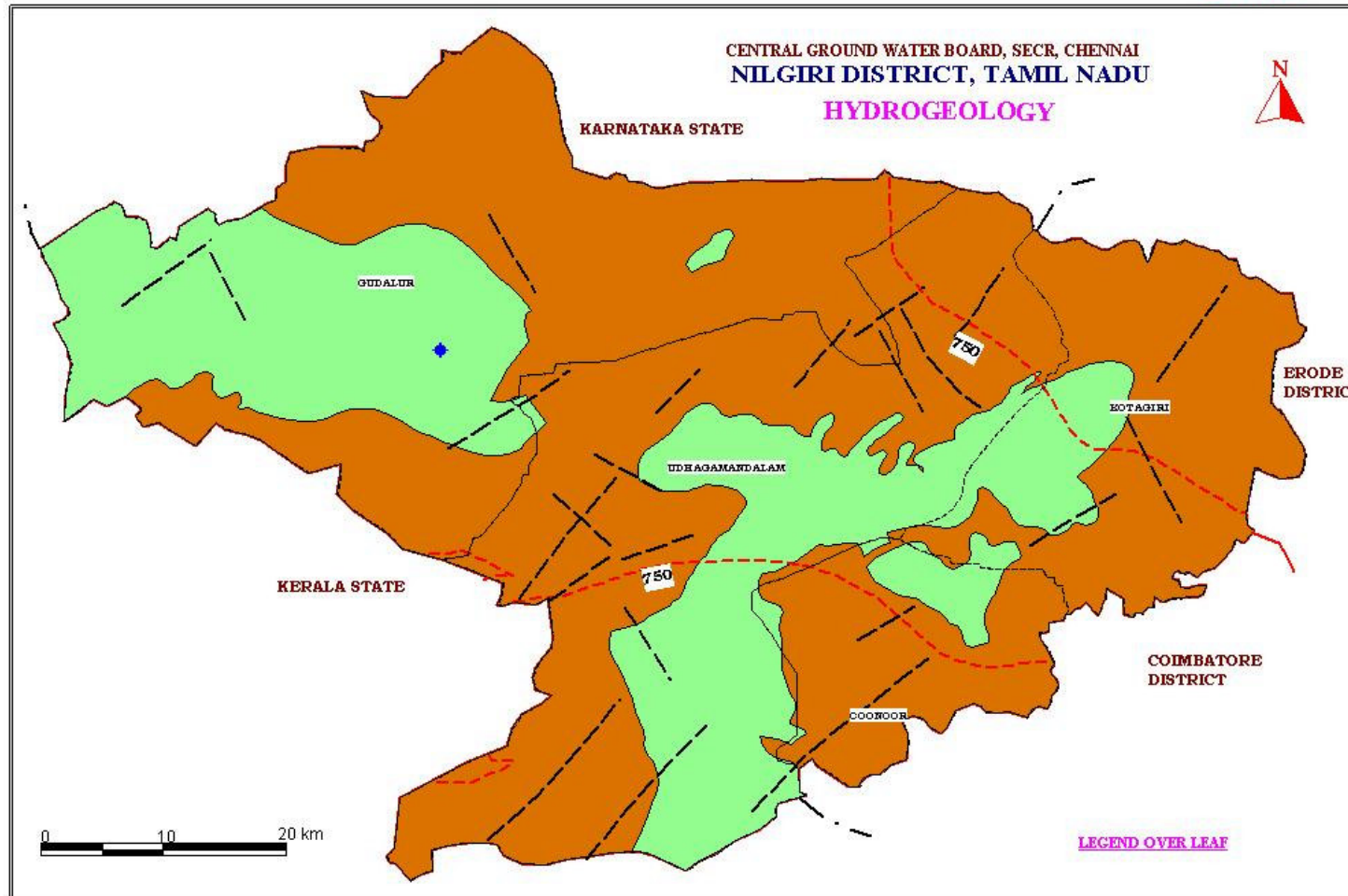
As the development of ground water very low in all the four blocks further development of ground water more additional irrigation potential has to be created. Proper water management methods must be adopted for further development of available ground water resources in the district.

A network of observation wells may be established in the urban areas to monitor the water quality on a regular basis.

Artificial recharge of ground water through cost-effective rainwater harvesting systems may be popularised in the district by providing incentives to individuals/communities embarking upon such initiatives. A concerted effort involving various Government agencies and NGOs can create the necessary awareness among the rural masses.





CENTRAL GROUND WATER BOARD, SECR, CHENNAI
NILAGIRI DISTRICT, TAMIL NADU
LOCATION
 (NOT TO SCALE)






LEGEND FOR PLATE - II

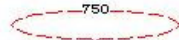
ADMINISTRATIVE SETUP

-  STATE BOUNDARY
-  DISTRICT BOUNDARY
-  BLOCK BOUNDARY
-  HILLY AREA


GROUND WATER HYDROLOGY

-  EXPLORATORY BOREWELL [CGWB]

HYDROCHEMISTRY

-  ISOCONS [Sp ELECTRICAL CONDUCTANCE [$\mu\text{s}/\text{Cm}$ at 25° C]

STRUCTURE

-  TRACE OF LINEAMENT

AQUIFER

AGE

LITHOLOGY

GROUND WATER CONDITIONS

YIELD PROSPECTS [CU.M/D]

GROUND WATER DEVELOPMENT STRATEGIES



CONSOLIDATED

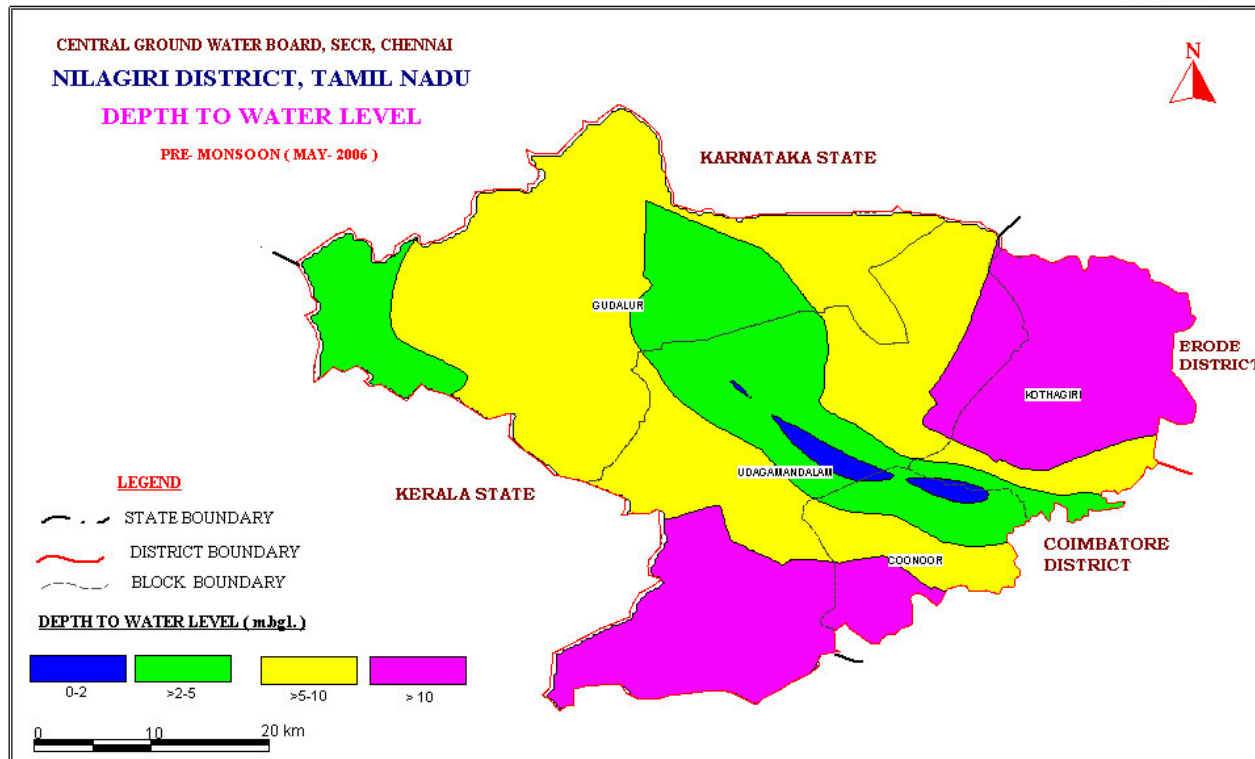
ARCHAEAN

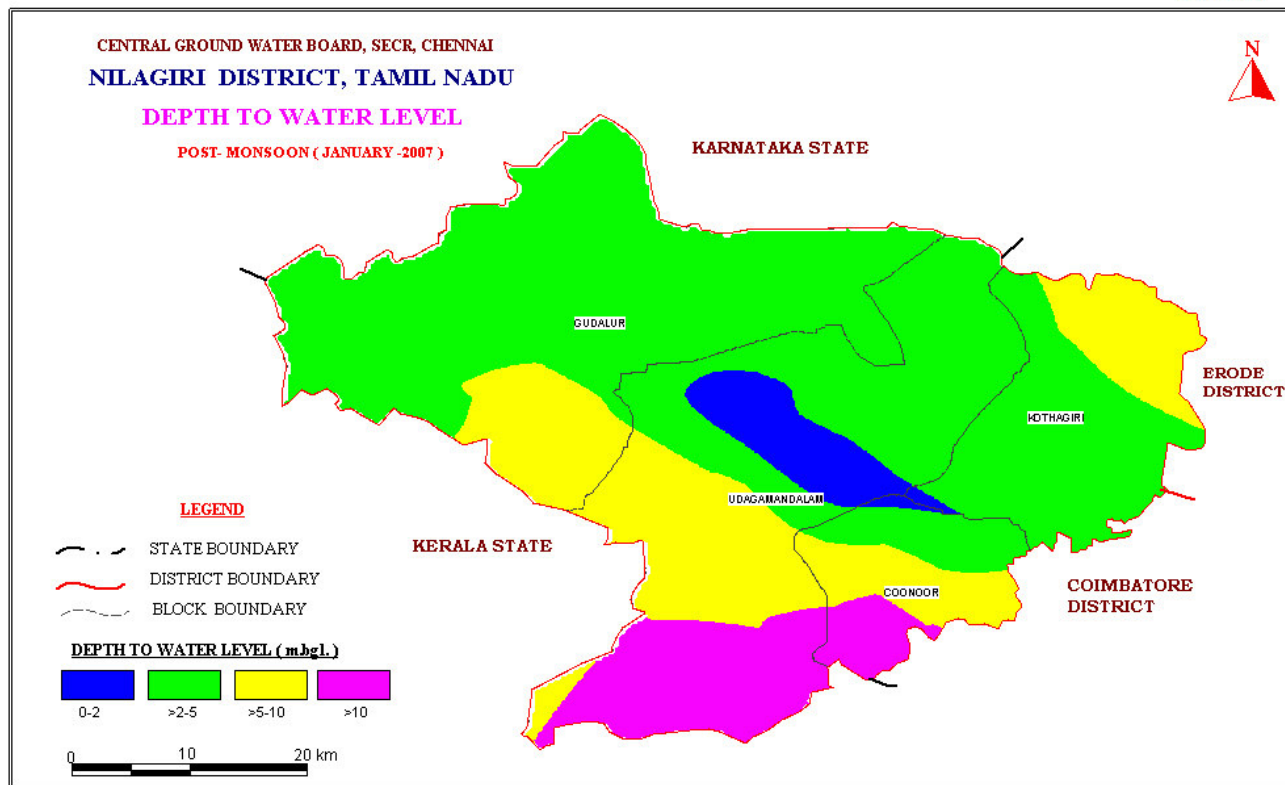
GRANITES, GNEISSES,
CHARNOCKITE.

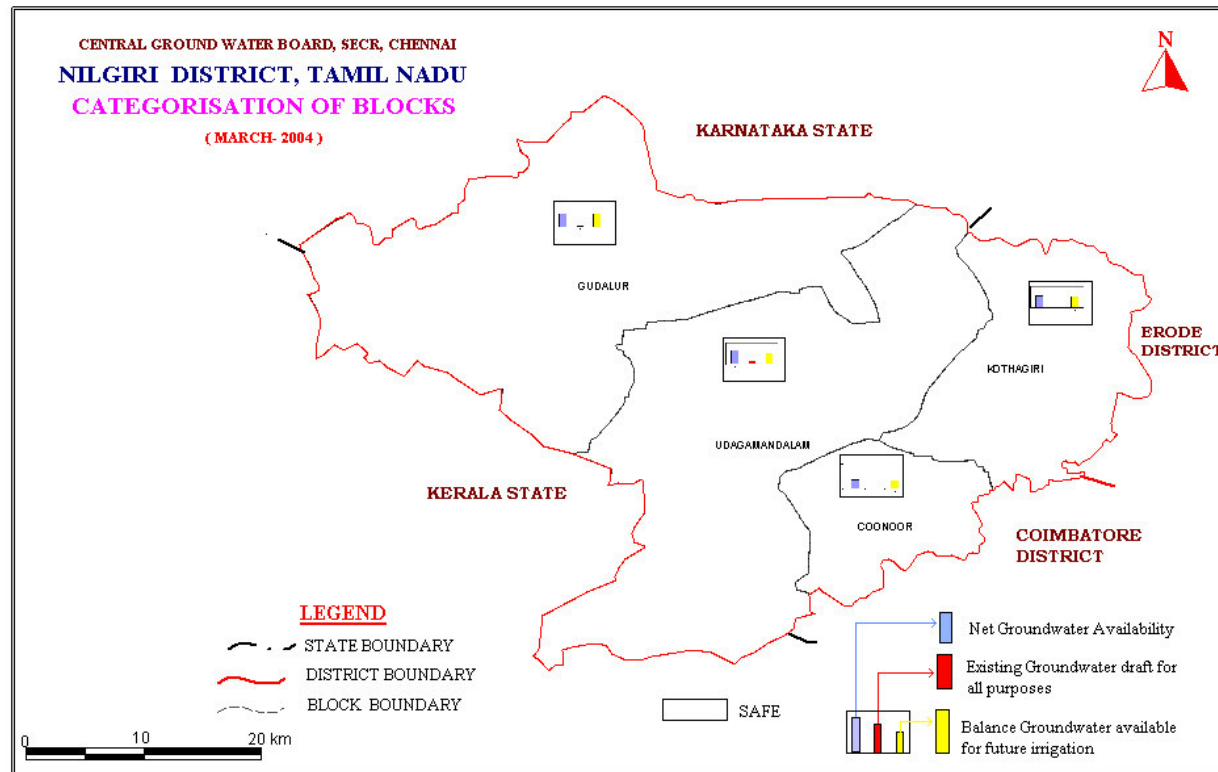
DISCONTINUOUS,
UNCONFINED TO
SEMICONFINED
AQUIFERS, RESTRICTED
TO WEATHERED
RESIDUUM
AND FRACTURES

< 50 NEAR
WATERSHED
DIVIDES & HIGH
GROUNDS. 50 - 200
NEAR THIRD ORDER
STREAMS AND LOW
GROUNDS.

SUITABLE FOR
DEVELOPMENT
THROUGH DUG
WELLS BOREWELLS
FEASIBLE IN FRACTURE
ZONES, BEST LOCATIONS
BEING INTERSECTION
OF FRACTURES







CENTRAL GOVERNMENT VETERINARY, ANIMAL AND FISHERIES SCIENCES COLLEGE
CENTRAL VETERINARY DEVELOPMENT FOUNDATION FOR
ANIMALS - RESEARCH PROGRAMS
BENGALURU DISTRICT, TISSAR ROAD















ANWARABAD



LEGEND FOR PLATE - VI

DISTRICT – NILGIRI

	Wells Feasible	Rigs Suitable	Depth Of Well (M)	Discharge (LPM)	Suitable Artificial Recharge Structures
 Hard Rock Aquifer	Dug Well	Manual	6 – 8	20	Check Dam/ Gully Plugging/ Gabion Structures
 Hard Rock Aquifer	Dug Well Bore Well	Manual Calyx\DTH	6 – 8 40 - 75	50 - 100	Check Dam/ Gully Plugging/ Gabion Structures
 Hard Rock Aquifer	Dug Well Bore Well	Manual Calyx\DTH	5 – 8 40 - 75	60 - 120	Check Dam/ Gully Plugging/Gabion Structures
	State Boundary			District Boundary	
	Hilly Area			Block Boundary	
	District Headquarters			Block Headquarters	
	River			Lineament	
	Recommended Site For Artificial Recharge Structure				

OTHER INFORMATION

Geographical Area	2549 Sq.Km
Number Of Blocks	4
Major Drainage	Moyar, Sigur, Pykara, Bhavani, Kundha, Kotagiri & Kallar
Population (2001)	7,64,826
Average Annual Rainfall	1202 To 3882 Mm
Annual Range Of Temperature	9 - 22°C
Regional Geology	Hard Rocks: Charnockite, Biotite Gneiss & Magnetite
Net Ground Water Availability For Future Irrigation	112 MCM/Yr
Stage Of Ground Water Development As On January 2003	4 %
Names Of Blocks Showing Intensive Ground Water Development	Nil

SAVE WATER

AND

CONSERVE WATER