जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET OF KANNUR DISTRICT, KERALA STATE

By

SARITHA.S, Asst. Hydrogeologist & VIKAS. C, Scientist B

KERALA REGION
KEDARAM, PATTOM PO
THIRUVANANTHAPURAM – 695 004
TEL: 0471-2442175
FAX : 0471-2442191

BHUJAL BHAVAN
NH-IV, FARIDABAD
HARYANA- 121 001
TEL: 0129-12419075
FAX:0129-2142524

GROUND WATER INFORMATION BOOKLET OF KANNUR DISTRICT, KERALA STATE

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DISTRICT AT A GLANCE

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1.	**GENERAL INFORMATION**	
	i) Geographical area (Sq km)	2966
	ii) Administrative Divisions (As on 31-03-2007) Number of Tehsil/Block Number of Panchayat/Villages	 3 / 9 81 / 129
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Lowland, Midland and Highland
	Major Drainages	Valapattanam, Anjarakandy.
3.	**LAND USE (ha)**	
	a) Forest area	48734
	b) Net area sown	202579
4.	**MAJOR SOIL TYPES**	Laterite, Brown hydromorphic, Coastal and river alluvium and Forest loamy soil
5.	**AREA UNDER PRINCIPAL CROPS (ha)**	Paddy - 11791 Coconut - 96975 Tapioca - 3945 Banana - 6422 Pepper - 24569 Arecnut - 13274 Cashew - 27757
6.	**AREA IRRIGATED BY DIFFERENT SOURCES (ha)**	
	Wells(Dug wells &Tube wells / Bore wells)	11054
	Tanks / Ponds	1756
	Canals	2171
	Other Sources	6073
	Net Irrigated area (ha)	16835

7.	**NUMBER OF GROUNDWATER MONITORING WELLS OF CGWB (AS ON 31-3-2007)**	
	No. of Dug wells No. of Piezometers	37 17
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Gneiss, Schist, Charnockite, Coastal Alluvium.
9.	**HYDROGEOLOGY** Major Water bearing formation	Weathered, fractured crystalline formations, laterites and Recent alluvium.
	Depth to water level (Pre-monsoon, 2006) Depth to water level (Post-monsoon, 2006) Long term water level trend in 10 years(1997-2006) in m/yr	1.75 to 20.48 m bgl 0.37 to 19.26 m bgl Rise – 0.009 to 0.536 Fall – 0.009 to 0.499
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)**	
	No. of wells drilled (EW, OW, PZ, SH, Total)	EW – 12, PZ –18, SH – Nil Total – 30
	Depth Range (m)	93 to 200
	Discharge (litres per second)	0.01 to 8.4
	Transmissivity (m^2/day)	1.44 to 81.27
11.	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limits	Quality is good. Major chemical constituents lie within the permissible limit.
12.	**DYNAMIC GROUNDWATER RESOURCES (2004) – in MCM**	
	Annual Replenishable Ground Water Resources	540.62
	Net Annual Groundwater Draft	261.18
	Projected demand for Domestic and Industrial Uses upto 2025	95.58
	Stage of Ground Water Development	48.31%

13.	**AWARENESS AND TRAINING ACTIVITY** Mass Awareness Programmes organized Date Place No. of Participants	 One 25-01-2002 Kannur 300
	Water Management Training Programmes organized Date Place No. of Participants	One 2006 Kannur 150
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No., Amount spent & Year)	2 Numbers. i) Mayyil S.C. Colony (Rs.1.53 lakhs, 2001) ii) Ezhimala Naval Academy(Rs.8.46 lakhs, 2001)
	Projects under technical guidance of CGWB (Numbers)	Nil
15.	**GROUND WATER CONTROL AND REGULATION**	
	Number of Over Exploited blocks	Nil
	Number of Critical blocks	2, Thalassery & Kuthuparambu
	Number of blocks notified	Nil
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Decline in water level, Water scarcity, Salinity ingress in coastal aquifers.

GROUND WATER INFORMATION BOOKLET OF KANNUR DISTRICT, KERALA STATE

1.0 INTRODUCTION

Kannur (Cannanore) district is one of the northern maritime districts of Kerala. It covers an area of 2966 sq km bounded by the North latitudes 11^0 40' 00'' and 12^0 20' 27''and East longitudes 75^0 10' 00'' and 75^0 56' 30''. It is bounded by Kasaragod district in the north, Kozhikode district in the south, Coorg district of Karnataka and Wayanad district in the east and the Lakshadweep Sea in the west.

1.1 Administration

Kannur district is divided into 3 taluks (Taliparambu, Kannur and Thalassery), 5 municipalities (Payyanur, Taliparambu, Kannur, Azhikode and Koothuparambu), 9 blocks (Payyanur, Kannur, Thalasserry, Taliparambu, Edakkad, Irikkur, Iritty, Peravur and Koothuparambu), 81 panchayats and 129 villages.

1.2 Drainage, Irrigation practices

Kannur district is mainly drained by the Valapattanam and Anjarakandy rivers. The other rivers are Kuppam, Mahe, Thalasserry etc. Dendritic is the common drainage pattern. The Valapattanam river, which is the longest in the district originates from Brahmagiri Reserve forest in Coorg district of Karnataka. The drainage area of the river in Kerala is 1321 sq.km. The Anjarakandy river originates from the Kannoth Reserve forest. The drainage area of the river is 412 sq.km.

Kannur district has 16,835 ha. area under irrigation, which accounts about 3.24% of the gross irrigated area of the state. Kannur district is provided with one major irrigation project along with some minor irrigation projects. The major irrigation scheme of the district is Pazhassi project. The command area fixed for Pazhassi project was 11525 ha of land. However only 8125 ha of land has been benefited through this project as on date. Ground water is also used for irrigation purposes. In addition to this, there are private tanks to facilitate the irrigation sector.

The index map showing location of blocks, drainage exploratory wells, piezometers and ground water monitoring wells are given in Figure1.

1.3 Works carried out by CGWB

Systematic hydrogeological survey in Taliparambu taluk of Kannur district was carried out by Sh. S.V.N.S. Rao. A report on the hydrogeological

conditions in Kannur was compiled by V.C. Jacob and P. Lakshminarayanan in 1980. Ground water management studies in Kannur district was carried out by Anadigayan during 2001-2002. Reappraisal groundwater survey in Mahe Region of the west coast for augmentation of water supply to Mahe were carried out by P. Lakshminarayanan in 1984-85. Water supply investigations were carried out by P. Subramanian and K.M. Najeeb in Electronics component complex and Ezhimala area. Exploratory drilling was carried out by CGWB during 1988-89 and 1998-2000.

2.0 RAINFALL & CLIMATE

Kannur district receives a total annual rainfall of around 3453 mm. District experiences heavy rainfall during the South West monsoon season followed by North East monsoon. South West monsoon during June to September contributes 70 % of the total rainfall of the year. The northeast monsoon contributes only about 30%. The distribution of rainfall during year 2000 to 2005 is shown in Table 1. Rainfall is considerably less during the period from January to May. The highest monthly rainfall was received in the month of June 2003 and lowest in the month of March 2005 (Figure 2).

Table 1: Monthly rainfall in Kannur district (Period 2000-2005)

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
2000	37.4		4.4	81.8	286.4	916.2	674.1	587.6	74.9	411.8	52.0	131.6	3258.2
2001				69.1	340.4	1191.8	902.7	509.8	175.0	376.0	49.7	2.0	3616.5
2002		2.2		8.6	13.3	1117.5	369.5	621.8	171.0	646.0	52.0	22.3	3024.2
2003	9.3		97.4	101.9	194.7	1396.0	445.2	417.9	145.9	345.2	70.8	1.8	3226.1
2004			4.0		69.2	828.0	1097.4	1163.8	55.5	127.6	97.6		3443.1
2005		2.8	1.4	12.2	84.8	1108.5	944.0	611.0	589.6	389.0	60.9	606	3864.8

The year to year variability of annual rainfall is around 28.2%. In general, the rainfall increases from the coast to the eastern hilly regions. Kannur district falls under wet type of climate based on Thornthwaite's climatic classification.

2.2 Meteorological Parameters

Apart from the rainfall, the meteorological parameters play an important role in groundwater balance estimation and other types of relevant studies.

Temperature

The temperature is more during the months of March to May and is less during December and January. The average mean monthly maximum temperature ranges from 28.4 to 36.9^{0}C and minimum temperature ranges from 19.7 to 23.9^{0}C.

Relative Humidity

Relative humidity is more during south west monsoon season (ie June to September). It is more during morning hours and is less during evening hours. Humidity ranges from 77 to 88 % in the district.

Evaporation

Evaporation is more during summer months of March to May and low during the months of June to November. The mean evaporation ranges from 2.6 to 5.7 mm/day.

Sunshine Hours

Generally good sunshine hours are recorded in the month of November to May. January to March records the maximum sunshine hours of more than 9.1 hours/day. The months of June to August records the minimum sunshine due to cloudy sky.

Wind

Wind speed ranges from 2.1 to 3.3 km per hour with mean speed of 2.6 km/hr. The wind speed is high during the period from March to June and low during the period from September to December.

Potential Evapotranspiration (PET)

The monthly PET ranges from 124.5 to 170.6 mm. PET values are lower than the monthly rainfall during the months of May to October indicating water surplus for possible recharge into groundwater regime during these months.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

Kannur district can be divided physiographically into three distinct geomorphologic units viz the coastal plains and lowlands in the western part, the central undulatory terrain comprising the midland region and eastern highland region. The coastal plains occurs as a narrow belt of alluvial deposits running parallel to the coast with a maximum width of about 15 km. Midland region forms a plateau land at certain places covered by a thick cover of laterites. The hilly tract in the eastern part consists of highly rugged terrains. The Ezhimala peak (259.69m) with the characteristic N-S alignment is a distinct physiographic unit in the coastal plains. Minor cliffs of laterite generally rising to an elevation of 50 to 60 m above mean sea level are found at Mahe, Thalasserry and Bekal coast. The midland region presents a plateau land covered by a thick cover of laterite. This is immediately to the east of the coastal strip, rising from 40 to 100 m above msl. The valleys in the plateau are gorge like and V shaped cut by youthful streams. The hilly tract along the eastern part of the district constitutes the highland region and is highly rugged. Development of bad land topography along the margins of the valley is a common feature observed in the district.

3.2 Soil types

There are mainly four types of soil observed in the district.

(1) Lateritic soil
(2) Brown hydromorphic soil
(3) Coastal and river alluvium
(4) Forest Loamy soil

(1) Lateritic soil – The predominant soil in the district is lateritic soil, which is the weathered product derived under humid tropical conditions. It occurs mainly in the midland and hilly areas characterized by rugged topography. They range from sandy loam to red loam.

(2) Brown hydromorphic soil – These are confined to the valleys between undulating topography in the midlands and in the low lying areas of the coastal strip in the district. These soils are brown in colour and the surface texture varies from sandy loam to clay. They have been formed as a result of transportation and deposition of materials from adjoining hill slopes and also through deposition by rivers.

(3) Coastal and river alluvium – The coastal alluvium is seen in the western coastal tract of the district. The coastal plain is characterized by secondary soils, which are sandy and sterile with poor water holding capacity. The width of the zone is more in the central part i.e., in the Kannur area and it is almost narrow in both north and southern areas of the district. The marshy soil in the coastal plain supports mangrove vegetation and is found at the estuaries and backwater extending inland along their courses. The soil is composed of recent deposits predominantly marine with some fluvial sediments along the coastline. These soils are immature with high sand content. River alluvium is found along river valleys cutting across the extensive lateritic soils. The soil is very deep with surface texture ranging from sandy loam to clay. It is fertile, having water holding capacity and plant nutrients which are regularly replenished during floods.

(4) Forest Loamy soil – These soils are found in the eastern hilly areas of the district and are characterised by a surface layer rich in organic matter. They are generally acidic and are dark reddish brown to black in colour with loam to silty loam texture.

4.0 GROUND WATER SCENARIO

Groundwater occurs under phreatic conditions in weathered mantle of the crystalline rocks, laterites and unconsolidated coastal sediments. It occurs under semi confined to confined conditions in the deep-seated fractured aquifers of the crystalline rocks and Tertiary sediments.

4.1 Hydrogeology

Kannur district is underlain by charnockites, pyroxene granulites, garnetiferous gneisses, hornblende biotite gneisses and schistose rocks overlain

by Tertiaries and coastal alluvium along the coast ranging in age from Archaean to Recent. These rocks have undergone weathering and lateritisation. The hydrogeological units encountered in the district are (i) consolidated formations (weathered and fractured crystallines) (ii) Semi consolidated sediments equivalent to Warkalies of Southern Kerala and Laterite formations and (iii) unconsolidated formations (Recent alluvium occurring along the coast).

Consolidated formations

The weathered and fractured rocks in the crystalline formations form potential phreatic shallow aquifers and is composed essentially of charnockites, hornblende gneisses, schists and other intrusives. In the phreatic crystalline formations the depth to water level varies from 4 to 13 m bgl during premonsoon and from 3 to 11 m bgl during post monsoon period. The wells located in charnockites vary in depth from 6 to 13 m bgl. The thickness of weathered zone in the district is in the range of 3 to 20 m. The degree of weathering is generally low in charnockite areas. The gneissic rocks are highly weathered and well jointed and form good water bearing zones. The yield of the wells ranges from 10 to 20 m^3 / day. They can sustain pumping only for an hour and recuperation rate is very poor.

The deeper fractured crystalline aquifers are under semi confined to confined conditions. They are tapped through borewells for domestic, agriculture purposes. The potential fractures are encountered at depth varying from 10 to 120 mbgl. The Board has constructed 12 Exploratory Wells in the district. Depth of wells ranges from 86 to 200 m bgl and the discharge ranges from 0.62 to 840 lpm. The details of wells drilled in hardrock area of the district are given as Annexure 1.

Semi consolidated formations

Tertiaries, equivalent to Vaikom beds of Southern Kerala occur along the coastal region of the district from Dharmadam (8 kms south of Kannur) upto the district boundary in the north. These are found to be lateritiitised on the top. Tertiaries are not potential aquifers in this district as they do not have potential fracture zones.

Laterite is considered to be the marker horizon to differentiate between Tertiary and Recent alluvial sediments. The thickness of laterite ranges from 10 to 20 m. Laterite constitutes a potential aquifer in the mid land regions of the district. Due to the porous nature of laterites, the dug well tapping laterite get recharged fast and also the recharge water escapes as sub surface flow and water level falls quite fast especially in wells located in topographic highs and steep slopes. The depth of dug wells in the laterite range from 8 to 23 mbgl. Depth to water level varies from 4 to 20 mbgl during premonsoon and 1.5 to 19 mbgl during post monsoon period. The yield of the wells ranges from 15 to 30 m^3/day.

Dug wells tapping laterites in the coastal area do not exist in the district as laterites occur at considerable depth below the coastal alluvium.

Unconsolidated formations

The coastal alluvium comprising of sand, silt and clay forms potential phreatic aquifers in the district. It occurs all along the coast and in the valleys and is extensively developed by a large number of dug wells and filter point wells. As per the data of bore holes drilled by CGWB, thickness of alluvium is generally low in Kannur district except around Mulappilangad where it is more than 20 m**.** The depth to water level in the dug wells during premonsoon ranges from 1.75 to 2.35 mbgl and 0.5 to 2.0 mbgl during post monsoon period. The details of wells drilled in sedimentary area of Kannur district is given as Annexure 2.

Water Level Fluctuation

The depth to water level in the pre monsoon and post monsoon periods are shown in Figures 3 and 4 and the hydrogeology of Kannur district is shown in Figure 5.

The long term water level fluctuation (1997 – 2006) in the district have been analysed using the historical data of observation wells in the district. The trend analysis for the pre monsoon period indicates that the water levels are showing a rising trend in about 66 % of the wells analysed and it ranges from 0.005 to 0.428 m/yr. Declining trend of water levels ranging from 0.002 to 0.648 m/yr have been observed in about 34 % of wells in the district. During post monsoon period, rising trend is observed in about 31% of the wells analysed in the district. The rise is in the range of 0.016 to 3.11 m/yr. Declining trend of water levels ranging from 0.052-1.933 m/yr have been observed in about 69 % of wells in the district.

4.2 Ground Water Resources

The ground water assessment was done block wise as per GEC-1997 methodology and is computed based on the data as on March 2004 and these figures are used in this report. The district has a net annual ground water availability of 540.62 MCM with a net availability of 272.21 MCM for the future use. The maximum stage of development is in Thalasserry block (150.79%) and the minimum development is in Irrikkur block (30.19%). Blockwise groundwater resources and categorisation of groundwater development of blocks as on 31st March 2004 are furnished in Table 1.

Table 1

Block- wise Groundwater Resources as on March 2004(in mcm)

Assessment Unit/Block	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for all uses	Allocation for domestic and industrial requirement supply up to next 25 years	Net Ground water Availability for future irrigation development	Stage of Ground water develop ment (%)
Payyannur	130.62	37.82	10.72	48.54	13.85	78.95	37.16
Taliparamba	90.03	28.45	12.86	41.31	15.89	45.69	45.88
Edakkad	40.04	17.39	9.54	26.93	11.49	11.16	67.26
Kannur	19.96	6.46	6.23	12.69	8.52	4.98	63.58
Irikkur	105.92	23.38	8.60	31.98	10.75	71.79	30.19
Iritty	59.57	17.11	6.56	23.67	8.27	34.19	39.73
Thalasserry	18.41	19.76	8.00	27.76	9.57	0.0	150.79

Kuthuparambu	30.73	20.82	8.89	29.71	10.76	0.0	96.68
Peravur	45.34	13.41	5.19	18.60	6.48	25.45	41.01
Total	**540.62**	**184.60**	**76.59**	**261.19**	**95.58**	**272.21**	**48.31**

Ground water withdrawal is taking place for irrigation, domestic and industrial purposes. The domestic and industrial requirements were computed as per the norms considering population of 2001 and also based on the projected population for the year 2025. The irrigation draft was calculated based on the number of ground water abstraction structure and the number of hours the well is in use per day and average number of day of irrigation in a year. The comparison of ground water draft of 1999 with 2004 data is given in Table 2 and is shown in Figure 6.

Table 2

Comparison of Stage of development, Total gross draft and categorization of blocks of Kannur district between 1999 and 2004 data

Sl. No.	Name of block	Net Ground water availability (MCM)	Total gross draft (MCM)		Stage of development		Categorization of blocks	
			1999	2004	1999	2004	1999	2004
1	Payyannur	130.62	36.94	48.54	17.94	37.16	Safe	Safe
2	Taliparamba	90.03	28.03	41.31	16.73	45.88	Safe	Safe
3	Edakkad	40.04	17.66	26.93	26.43	67.26	Safe	Safe
4	Kannur	19.96	6.12	12.69	19.40	63.58	Safe	Safe
5	Irikkur	105.92	23.66	31.98	13.45	30.19	Safe	Safe
6	Iritty	59.57	18.55	23.67	26.71	39.73	Safe	Safe
7	Thalasserry	18.41	19.62	27.76	30.23	150.79	Safe	Critical
8	Kuthuparambu	30.73	23.41	29.71	59.07	96.68	Safe	Critical
9	Peravur	45.34	12.36	18.60	17.81	41.01	Safe	Safe

As per the categorisation of blocks based on 1999 data all the blocks were under safe category but as per the 2004 data computations, Thalasserry and Kuthuparambu blocks became ‘Critical’ and the remaining six blocks under ‘Safe’ category (Figure 7).

4.3 Ground Water Quality

The chemical quality of groundwater has been evaluated by analysing 37 samples from Ground Water Monitoring Wells (GWMW) during pre-monsoon (April, 2006). The Electrical Conductivity of water from shallow aquifer ranges

from 34 to 1070 µs/cm at 25^0C. About 95% of shallow aquifer samples show EC less than 250 µs/cm at 25^0C. Ground water samples having EC around 1000 µs/cm at 25^0C have been noticed in areas very near to the coast and tidal zones. Deeper aquifer samples are characterized by high EC values ranging from 204 - 802 µs/cm. The hardness of shallow aquifer samples varies from 8 to 350 ppm showing the soft nature of water. All the water samples shown fluoride within the permissible limit. The maximum value recorded was 0.18 ppm. The water from springs are also very fresh and is suitable for all purposes. In general the quality of water in phreatic and deep fracture zones are suitable for domestic, industrial and irrigation purposes. The data of chemical analysis of dug well samples are presented in Annexure 3.

4.4 Status of Ground Water Development

The shallow phreatic aquifers in alluvium are developed by a large number of dug wells and filter point wells. The yield of dug wells tested in the area ranges from 8 to 40 m^3/day.

The depth of dug wells in the laterite range from 8 to 23 mbgl. The yield of the wells ranges from 15 to 30 m^3/day and can sustain pumping for a period of less than an hour to 3 hours. Generally large diameter wells are constructed in laterite terrain and the diameter ranges from 2.0 to 4.0 m. Dug wells located in the topographic highs and ridges dry up in summer.

Dug wells in the weathered crystallines have yield in the order 10 to 20 m^3/day. The well tapping these aquifers range in diameter from 2 to 5 m and their depth varies from 5 to 20 m bgl.

In the fractured crystallines rocks, borewells are constructed to the depth which ranges from 30 to around 110 m bgl. Potential zones are encountered between 25 and 80 m bgl. CGWB drilled only 12 borewells of 200m depth under groundwater exploration programme in the district. The yield of bore well ranges from negligible discharge to 50,000 lph. The data from exploratory drilling carried out by CGWB revealed that the E-W lineaments, followed by N-S lineaments are found to be potential in the district.

The cost of construction of dug wells in alluvium and valley fills comes to Rs. 20,000 to 25,000 including the cost of pump set. In weathered crystalline it may go up to Rs. 30,000. The dug wells were deepened in laterites and the crystalline areas at places to about 1 to 4 m due to the fall in water level. Bore well culture is fastly spreading in the district due to which the deeper fractured aquifers are more strengthened at places/ isolated pockets. .

The lifting devices of water are through centrifugal pumps, jet pumps for dug wells and submersible pumps and compressor for borewells. Water is also being lifted by bucket and rope from dug wells for domestic purposes.

To meet the ever increasing demand for water in the district, Kerala Water Authority and Grama Panchayats are empowered with the supply of water for domestic purpose. Public tube wells, dug wells, tanks/ponds and taps/handpumps are employed for urban and rural water supply. The Kerala Water Authority has 679 borewells, and 150 dug wells for water supply in the

district. Spring is used to mitigate drinking and irrigation water supply. In addition to this, most of the houses have their own wells to meet the domestic requirements.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground water development

Groundwater in the district is mostly developed through dug wells, dug cum borewells, borewells and filter point wells for domestic and irrigation purposes. Most of the households have their own wells to meet the domestic requirements. Recently in most of the areas groundwater is developed through borewells for domestic and irrigation purposes.

Groundwater development and management should be coupled with rainwater harvesting. Conjunctive use of surface and groundwater shall be practiced effectively. Artificial recharge schemes should be practiced in large scale along with rain water harvesting. The springs seen in the eastern part of the district can be developed. 34 springs are located in mid upland, highland and partially in coastal areas of the district (CWRDM). It has been found that spring discharge varies from 1 to 480 lpm. These are the perennial source for drinking water schemes that can be effectively utilised to mitigate drinking and irrigation water scarcity in those areas.

More stress should be given for water shed management. There should be proper water budgeting in the district. Mass awareness and training programmes shall be carried out in panchayat level to make people aware about the importance of conservation and protection of groundwater.

5.2 Water Conservation and Artificial Recharge

Watershed management practices should be given utmost importance which in turn will help to conserve the groundwater and supplement the recharge. Roof-top rain water harvesting can be practised in areas like Chamberi, Poyilur and Thalasserry where all the dug wells go dry during summer. Borewells can be recharged using rain water especially in critical blocks like Thalasserry and Kuthuparambu. In coastal areas of the district like Azhikode, Azhikkal, Edakkad, Dharmadam, Muzhapilangad, Kannapuram, Mahe and Cherukunnu, rainwater harvesting schemes can be practiced to avoid more stress on the shallow aquifer. Contour bunding, trenching, nalla bunding, check dams, percolation tanks and subsurface practices like recharge shaft, dugwell recharge and water conservation structures like sub-surface dyke are suitable for midland areas of Kannur district. The artificial recharge schemes recommended in different blocks are presented in Figure 8.

CGWB has implemented artificial recharge and rain water harvesting schemes in Kannur district as detailed below.

Sl.No.	Location	Type of Structure	Year
1	Mayyil S.C. Colony	Roof top rain water harvesting	2001
2	Ezhimala Naval Academy	Roof top rain water harvesting, Check dams, Recharge pit.	2001

Physiographically, the Mayyil S.C. Colony is located on a small hillock comprising about 25 families. Due to rainfall runoff and base flow discharge, the water level is very deep in summer. The only available dug well get dried up early in March. Further the inhabitants have to go to foot hills for bringing drinking water. To facilitate additional recharge, a scheme for roof top rain water harvesting was suggested. Roof top rain water from 10 houses were collected and delivered to a pit near to the existing dug well through PVC pipes. Project was completed on August, 2001 at the cost of Rs.1.53 lakhs. After the completion of the scheme, water level in the dug well of the colony have risen during post-monsoon. During summer, the well could provide drinking water to the colony population through out the month of March and upto mid April.

Ezhimala Naval Academy is situated on a hillock near the coast underlined by crystalline rocks. Due to the undulating nature of the terrain, heavy runoff occurs during rainy season and natural recharge is quite low. Hence to facilitate recharge, artificial recharge schemes were implemented with the construction of roof top rain water harvesting and recharge pit, gully plugging cum drainage line treatment/checkveir etc. Construction completed in three phases and the total cost of the project comes around 8.46 lakhs.

Since 1964, Soil Conservation Department constructed several soil and water conservation structures like check dams, gully plugs, percolation ponds, husk burial, centripetal terrace, retaining walls for stream bank protection etc. and covered approximately more than 45 watersheds in the Kannur district under different schemes like Rural Infrastructure Development Fund (RIDF) aided by NABARD; NWDPRA under Central Govt. Schemes, Western Ghat Development Project (WGDP), People's Participation Scheme (PPS) and Tribal Support Programme (TSP) under Kerala State Govt. Water conservation society (WCS), Kannur. Also carried out artificial recharge studies in the premises of Kannur Central Jail, Defence Security Corps (DSC), Kannur and Kunnathuparambu panchayats.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Decline in water level, water scarcity and pollution due to saline water intrusion are some of the major problems noticed in the district. Thalasserry and Kuthuparambu blocks having a stage of ground water development of 150.79 % and 96.68% respectively can be demarcated as vulnerable area on consideration of depletion of ground water level. Water scarcity is a severe problem faced by villagers living in hilly terrains due to the drying up of wells in summer season. Dug wells in the midland region also get dried due to the delay of monsoon rains or to the absence of summer showers. Based on the studies the following areas

are identified as water scarce areas and these areas need special attention as below.

Sl. No	Location	Depth to water level April, 2006 (mbgl)	Depth to water level, Nov, 2006 (mbgl)	Fluctuation (m)
1	Chakkarakale	14.29	10.37	3.92
2	Cheleri	11.76	7.58	4.18
3	Irikkur	15.18	8.22	6.96
4	Manattana	16.64	13.02	3.62
5	Mathamangalam	9.03	3.36	5.67
6	Mattanur	10.65	6.37	4.28
7	Peringome	14.46	10.26	4.20
8	Pukkundu	13.25	7.12	6.13

In coastal areas of the district like Azhikode, Azhikkal, Edakkad, Dharmadam, Muzhapilangad, Kamapuram, Mahe and Cherukunnu, brackish to saline water has been identified in aquifers due to intrusion of saline water from nearby backwater shallow channels.

The problems encountered in drilling in hard rock areas of the district are thick overburden, boulder/large weathered formation below overburden and backpressure. Mud loss and caving are the main problems encountered in drilling and construction of tube wells in coastal sedimentary terrain of the district.

7.0 AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programme (MAP) and Water Management Training Programme (WMTP) by CGWB

One Mass Awareness Programme (MAP) on conservation and protection of groundwater was conducted at Kannur in 2002. In this programme, the hydrogeological conditions of Kannur district, the measures for water conservation and protection were discussed. The programme witnessed a gathering of more than 300 people.

One Water Management Training programme (WMTP) was conducted at Kannur in the year 2006. More than 150 participants attended the training. In the programme, the participants are trained on various methods adopted for rainwater harvesting, artificial recharge to groundwater and the structures suitable for water conservation in different areas of the district. The general hydrogeological conditions of the district were also discussed.

8.0 AREAS NOTIFIED BY CGWA/SGWA

No area/block is identified for notification either by CGWA or State Groundwater Department in Kannur district.

9.0 RECOMMENDATIONS

The stage of groundwater development in Kannur district as on 2004 is 48.31 % leaving wide scope for future development. Of the nine blocks seven are under safe category and two are critical category. In 1999 all the blocks were in safe category.

The groundwater development in Thalasserry and Kuthuparambu blocks are found to be more as compared with other blocks. Caution has to be exercised in the development of Edakkad block due to the falling trend in water level in both pre and post-monsoon seasons. Hence, future development may be restricted in these blocks.

As the number of abstraction structures including private borewells is on the increasing trend in the district, proper census of abstraction structures is necessary for recommending new ones for future development. Groundwater development should be limited with conjunctive use of rainwater and surface water as the district is drained by very large number of rivers. More stress should be given for watershed development and management. The existing water resources viz. dug wells, ponds & tanks should be protected and conserved. In the district, there are 34 numbers of springs identified, which are not been developed so far effectively. Hence, attention may be given for the proper development of springs as they form perennial sources for drinking water.

There should be proper water budgeting in the district. In addition to the major irrigation project Pazhassi, there are plenty of minor irrigation and water supply schemes in the district, which require proper maintenance and attention. Emphasis should be given to micro level water supply projects. Block wise micro level study is recommended especially in critical blocks like Thalasserry and Kuthuparambu to get more realistic picture of groundwater development and to study the scope for future development. If necessary, regulatory measures are to be taken in such areas to control over exploitation of groundwater resources, promoting artificial recharge and preventing groundwater pollution.

Mass awareness and training programmes may be organised in Panchayath level to create awareness among people about the importance of conservation and protection of groundwater. A technical database has to be created at CGWB Regional Office, incorporating data from GWD and other agencies. This may be disseminated to the public through local bodies and NGOs.

Figure 1

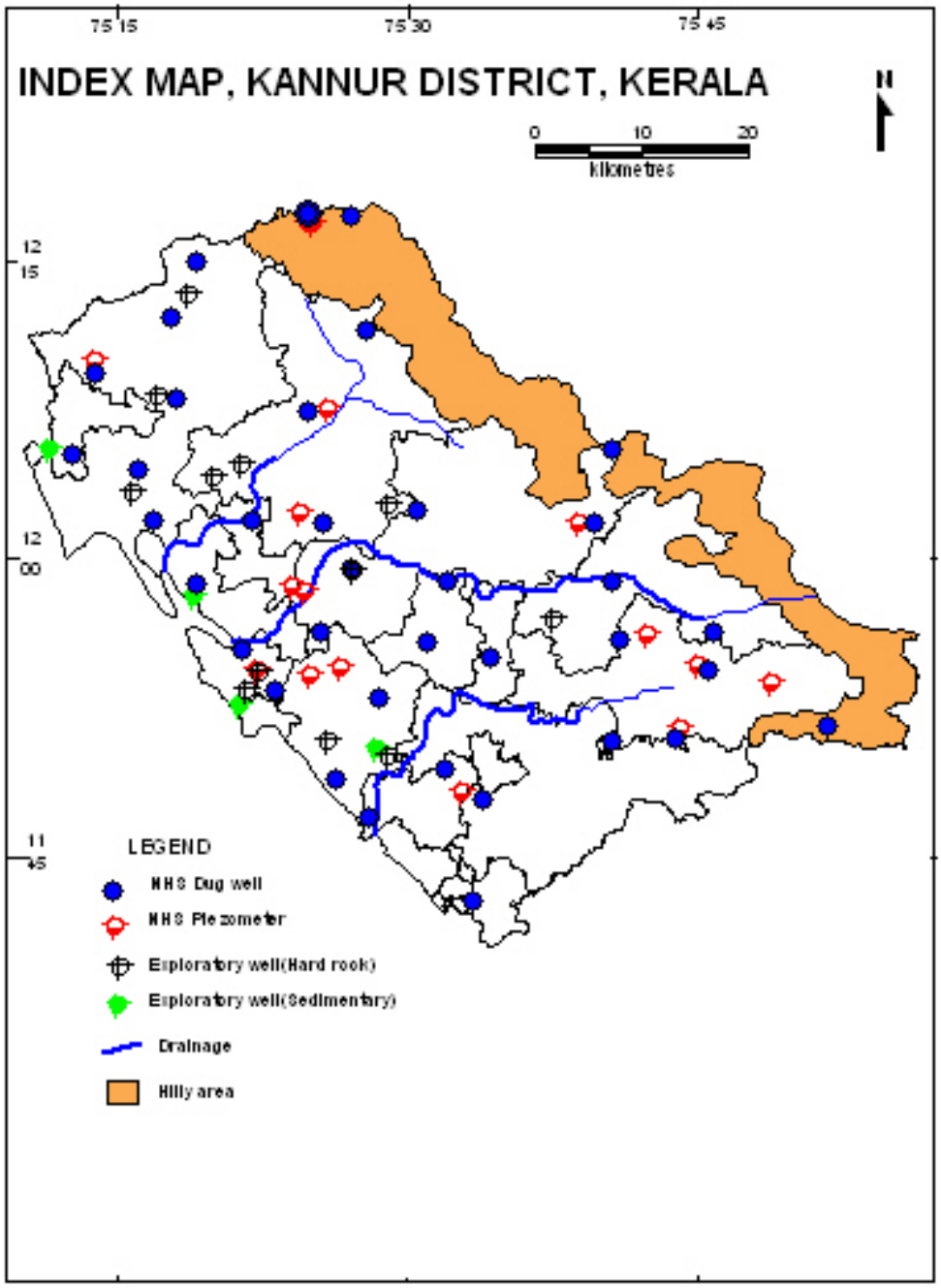

INDEX MAP, KANNUR DISTRICT, KERALA
75 15
75 30
75 45
12 15
12 00
11 45
N
0 10 20
kilometres
LEGEND
NHS Dug well
NHS Piezometer
Exploratory well(Hard rock)
Exploratory well(Sedimentary)
Drainage
Hilly area

Figure 2

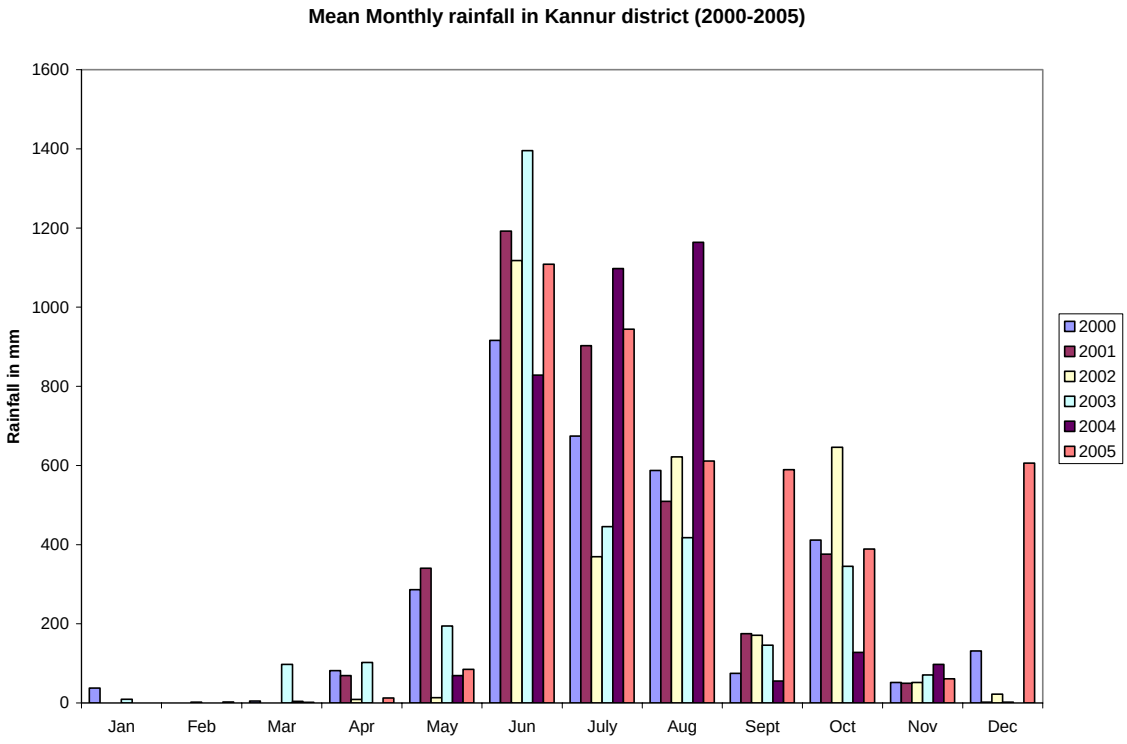

Mean Monthly rainfall in Kannur district (2000-2005)
Rainfall in mm
1600
1400
1200
1000
800
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
July
Aug
Sept
Oct
Nov
Dec
2000
2001
2002
2003
2004
2005

Figure 3

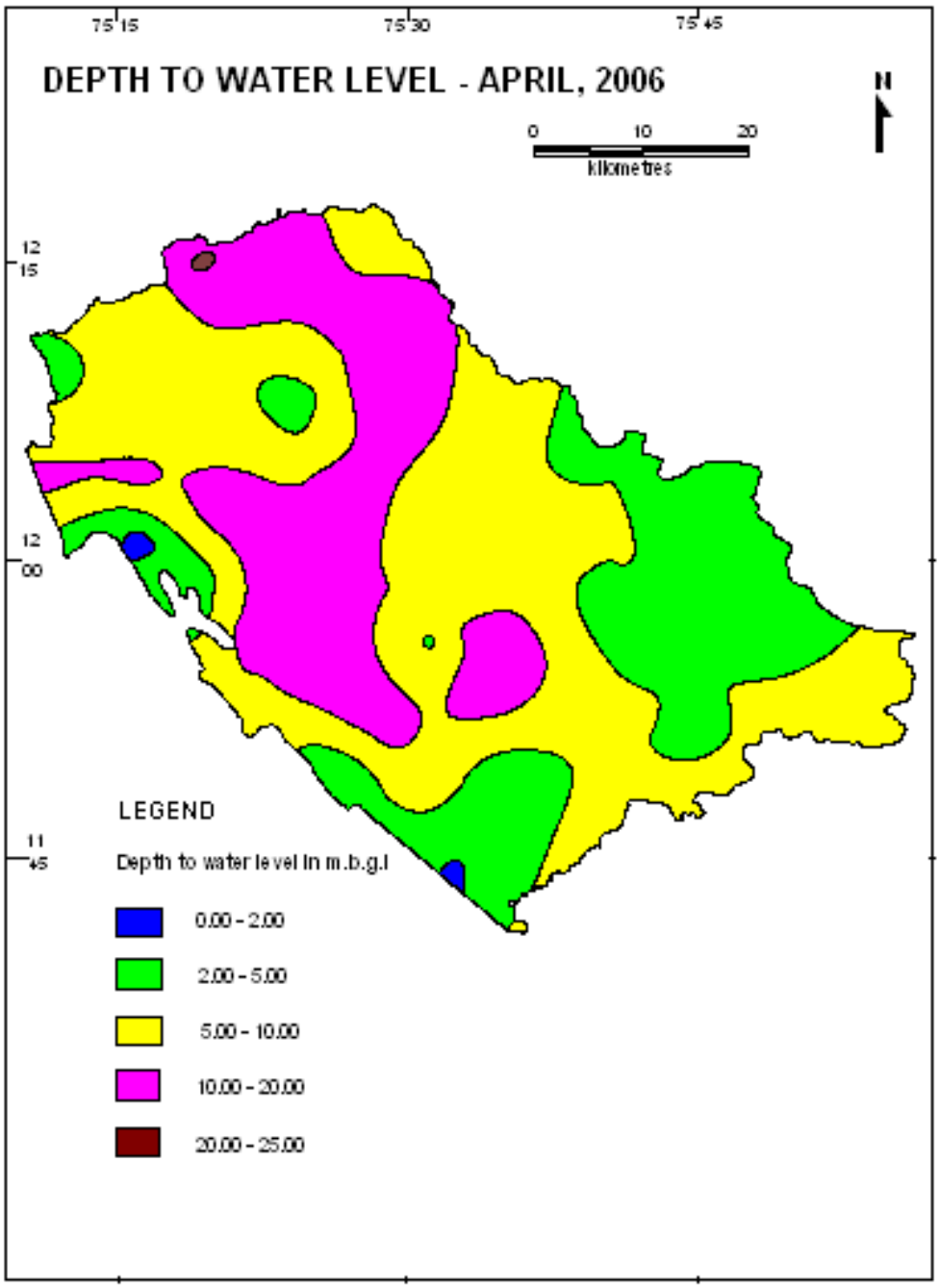


Figure 4

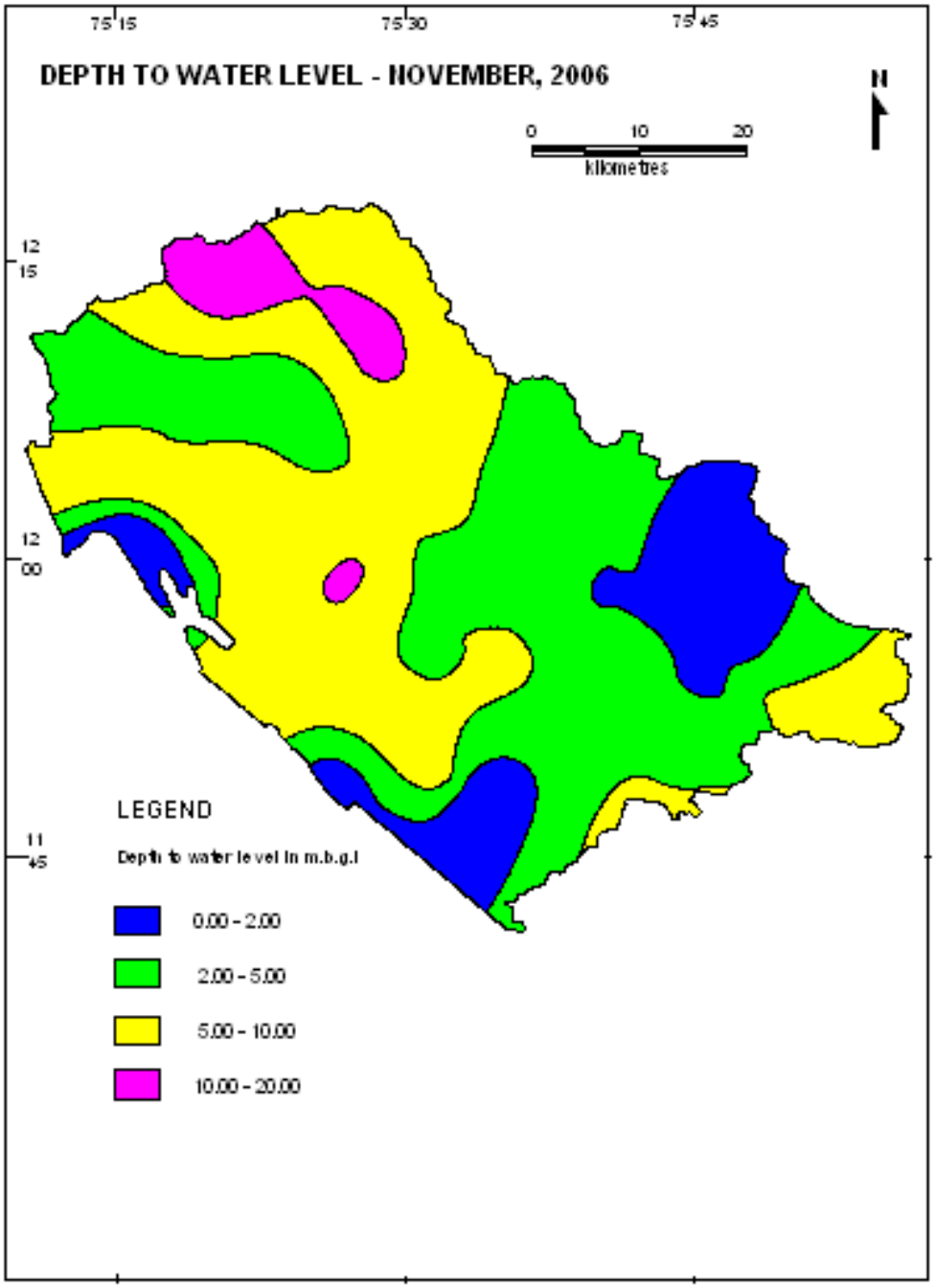

75°15
75°30
75°45
DEPTH TO WATER LEVEL - NOVEMBER, 2006
N
0
10
20
kilometres
12°15
12°00
11°45
LEGEND
Depth to water level in m.b.g.l
0.00 - 2.00
2.00 - 5.00
5.00 - 10.00
10.00 - 20.00

Figure 6

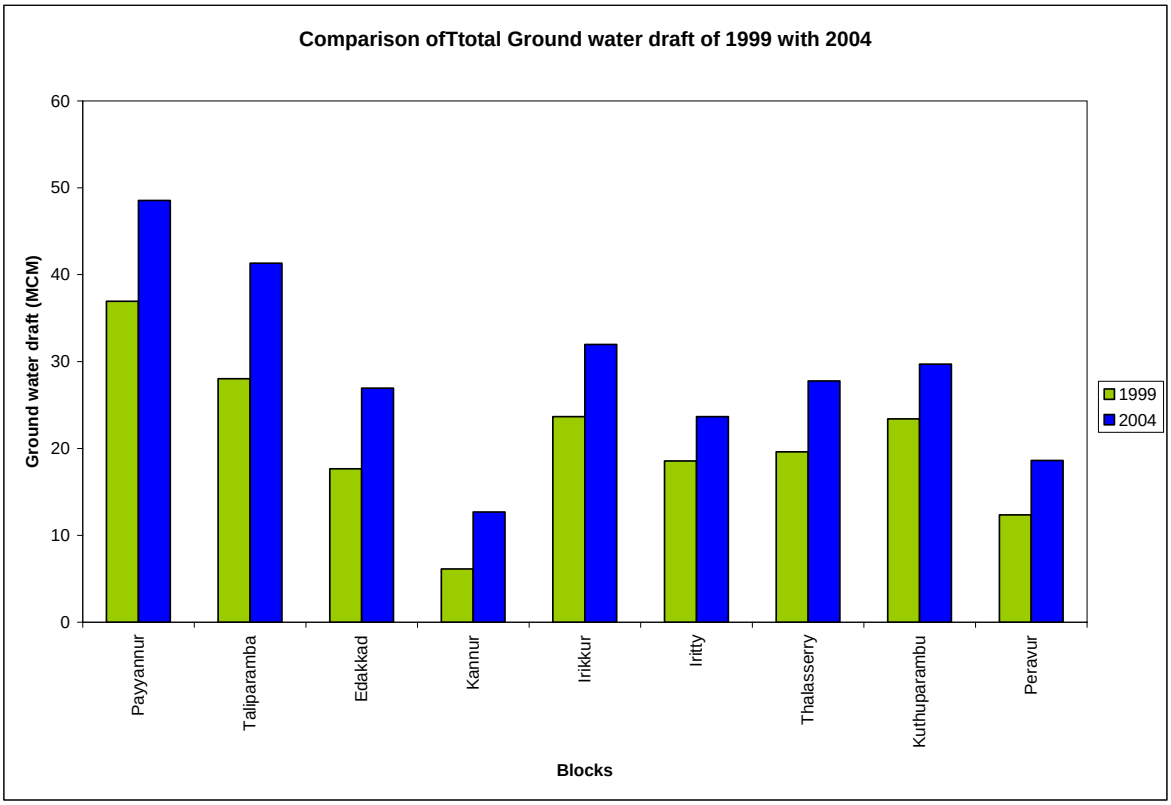

Comparison ofTtotal Ground water draft of 1999 with 2004
Ground water draft (MCM)
60
50
40
30
20
10
0
Payyannur
Taliparamba
Edakkad
Kannur
Irikkur
Iritty
Thalasserry
Kuthuparambu
Peravur
Blocks
1999
2004

Figure 7

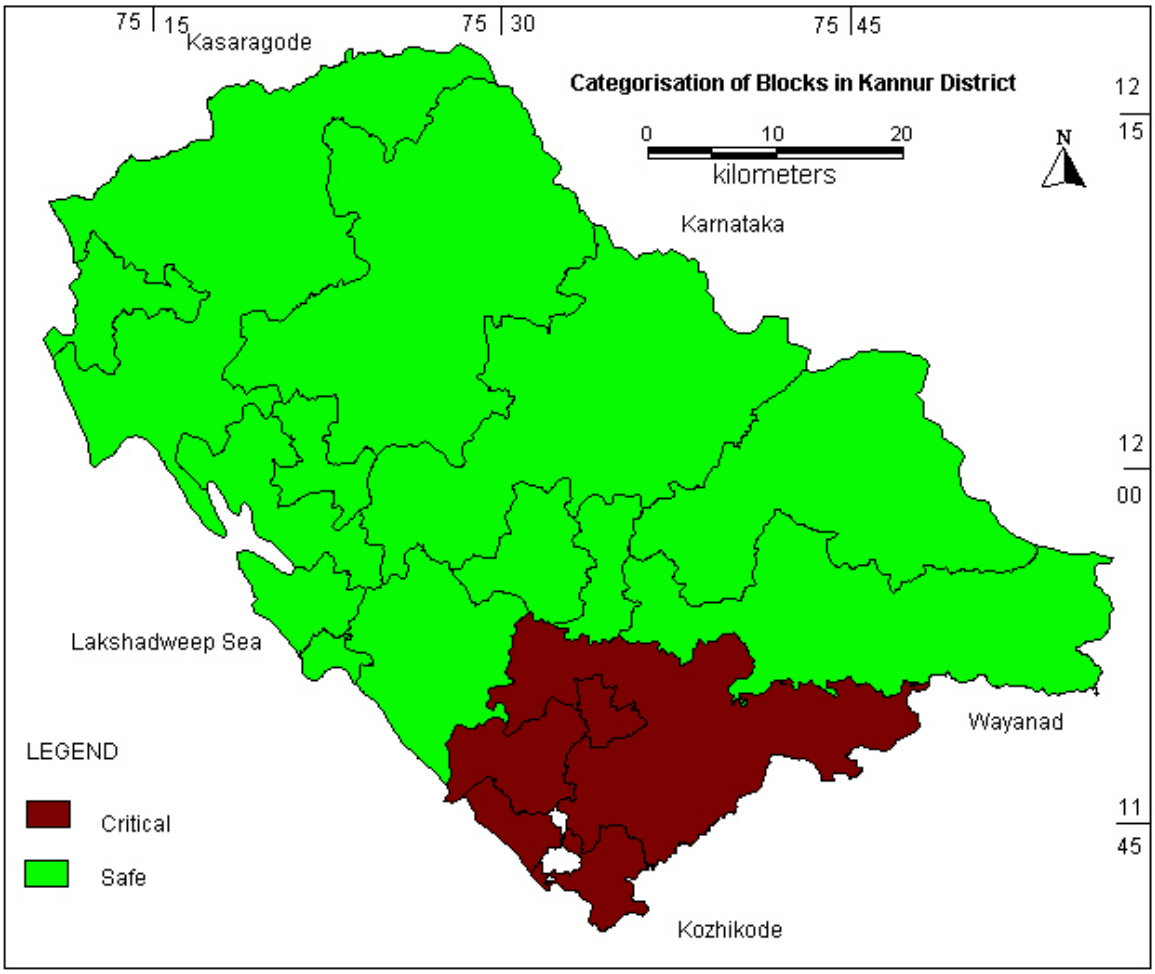
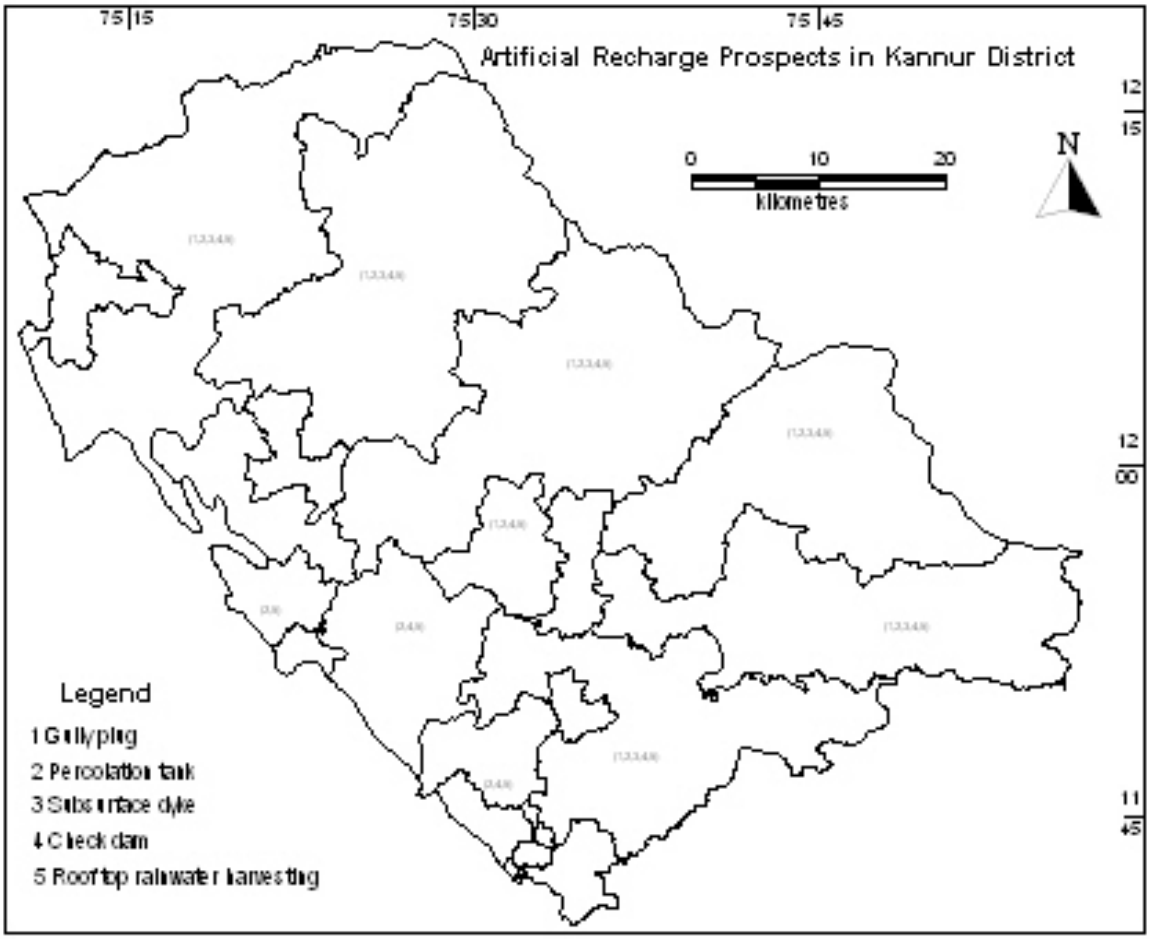


Figure 8


75|15
75|30
75|45
Artificial Recharge Prospects in Kannur District
12|15
12|00
11|45
0
10
20
kilometres
N
Legend
1 Gully/plug
2 Percolation tank
3 Subsurface dyke
4 Check dam
5 Rooftop rainwater harvesting

Annexure 1

Details of wells drilled in hard rock areas of Kannur district

Sl. No.	Location	Year of construction	Lineament Direction	Depth drilled	Depth of casing mbgl	Fracture zones	Discharge lpm during drilling	Rock type
1	Mangatuprambu	1998-99	NW-SE	200.00	13.70	15.0-17.0 50.5-54.0 103.0-106.0	240	Charnockite
2	Chavasseri	1999-00	E-W	86.80	11.90	-	840	Syenite
3	Chengala	1999-00	E-W	157.00	34.20	-	480	Garnet gneiss
4	Iringal	1999-00	N-S	175.00	33.00	-	180	Garnet gneiss
5	Mayyil	1999-00	E-W	92.90	22.80	-	504	Charnockite
6	Perul	1999-00	N-S	200.00	22.20	26.0-28.0 71.0-80.0	240	Hornblende Biotite Gneiss
7	Peringome	1999-00	NE-SW	200.00	-	16.5-18.5	12	Granite Gneiss
8	Vellora	1999-00	N-S	200.00	17.80	-	107.4	Charnockite Gneiss
9	Cheruthazham	1999-00	N-S	187.30	36.60	-	261.6	Hornblende Biotite Gneiss
10	Kannur CWRDM	1999-00	N-S	200.00	31.50	-	0.6	Biotite Gneiss
11	Chala	1999-00	E-W	200.00	21.70	40-43	60	Biotite Gneiss
12	Peralassery	1999-00	N-S	200.00	35.00	78.0-79.0 99.0-100.0 148.0-150.0	162	Quartz Mica Schist

Annexure 2

Details of wells drilled in Sedimentary area, Kannur district

Sl. No.	Location	Co-ordinates & Totposheet No.	Year of Construction	RL m amsl	Depth drilled (mbgl)	Depth constructed mbgl	Zones tapped	Discharge (lps)	Remarks
1	Mulappilangad	12°50'20" 76°28'25" 58 M/5	1996	1.43	22	20.75	16.75-20.75 (Recent)	1.5	SWL – 2.09 m bgl
2	Kannur	11°52'30" 75°21'15" 49 M/15	1996	11.13	38.75	38.75	18-20	0.4	SWL – 13.00 mbgl
3	Eranvu	11°58'00" 75°19'00" 48 M/15	-	NA	28.95	NA	NA	NA	Slim hole
4	Payyanur	12°05'30" 75°11'30" 48 P/4	-	NA	35.52	NA	NA	NA	Slim hole

Annexure 3

Chemical Analysis Data of GWMW in Kannur district

Sl.No	Location	Date of collection	EC in us/cm at 25^0C	Total Hardness	Ca	Mg	Cl	F
				<----------in mg/litre---------->				
1	Mahe	2006.04.05	1070	350	116	15	149	0.18
2	Pattiyam	2006.04.05	74	8	2.4	0.5	13	0.07
3	Pathiriyad	2006.04.05	45	8	2.4	0.5	9.9	0.11
4	Mattanur	2006.04.05	198	48	11	4.9	30	0.14
5	Edayannur	2006.04.06	46	10	3.2	0.5	7.1	0.11
6	Chakkarakalle	2006.04.06	243	34	5.6	4.9	51	0.04
7	Cheleri	2006.04.06	34	8	2.4	0.5	5.7	0.06
8	Mayyil	2006.04.06	87	16	4	1.5	17	0.02
9	Valapattanam	2006.04.06	120	22	6.4	1.5	18	0
10	Kannur	2006.04.06	405	120	39	5.4	50	0.03
11	Edakkad	2006.04.06	186	38	12	1.9	30	0.05
12	Dharmadam	2006.04.06	147	32	11	1	26	0.06
13	Kannavam	2006.04.06	64	18	4.8	1.5	7.1	0
14	Kommeri	2006.04.06	55	22	4	2.9	2.8	0
15	Manatana	2006.04.07	110	30	8	2.4	14	0.16
16	Kottiyur	2006.04.07	79	26	5.6	2.9	7.1	0
17	Aralam	2006.04.07	35	10	3.2	0.5	4.3	0.11
18	Mulakunnu	2006.04.07	88	22	4.8	2.4	11	0.07
19	Iritty	2006.04.07	59	12	4	0.5	7.1	0
20	Ulikkal	2006.04.07	53	14	4.8	0.5	8.5	0.02
21	Mattara	2006.04.07	61	20	4	2.4	5.7	0.17
22	Irikkur	2006.04.07	191	78	17	8.6	11	0.09
23	Sreekantapuram	2006.04.07	143	8	6.4	2.9	20	0.02
24	Pukkundu	2006.04.07	85	28	6.4	2.9	4.3	0.15
25	Chepparapadavu	2006.04.07	65	20	4	2.4	5.7	0.03
26	Alacode	2006.04.07	94	24	6.4	1.9	9.9	0.04
27	Taliparamba	2006.04.07	169	62	13	7.3	8.5	0.09
28	Cheruthazham	2006.04.08	40	8	1,6	1	7.1	0.03
29	Chooral	2006.04.08	77	32	12	0.5	5.7	0.03
30	Peringome	2006.04.08	123	48	14	3.4	9.9	0.07
31	Vaikkara	2006.04.08	174	72	1.4	8.8	2.8	0.2
32	Kozhichal	2006.04.08	51	18	4	1.9	4.3	0.01
33	Ramanthali	2006.04.10	41	8	3.2	0	8.5	0.02
34	Ettikulam(new well)	2006.04.10	65	14	4.8	0.5	9.9	0.06
35	Pazhayangadi	2006.04.10	207	68	22	2.9	13	0.15
36	Kannapuram	2006.04.10	172	72	24	2.9	16	0.18
37	Mathamangalam	2006.04.08	69	14	4	1.00	11.00	0.02