
WELL COME

INSIGHT ON WATER RESOURCES MANAGEMENT IN THE U.T.OF PUDUCHERRY.

BY

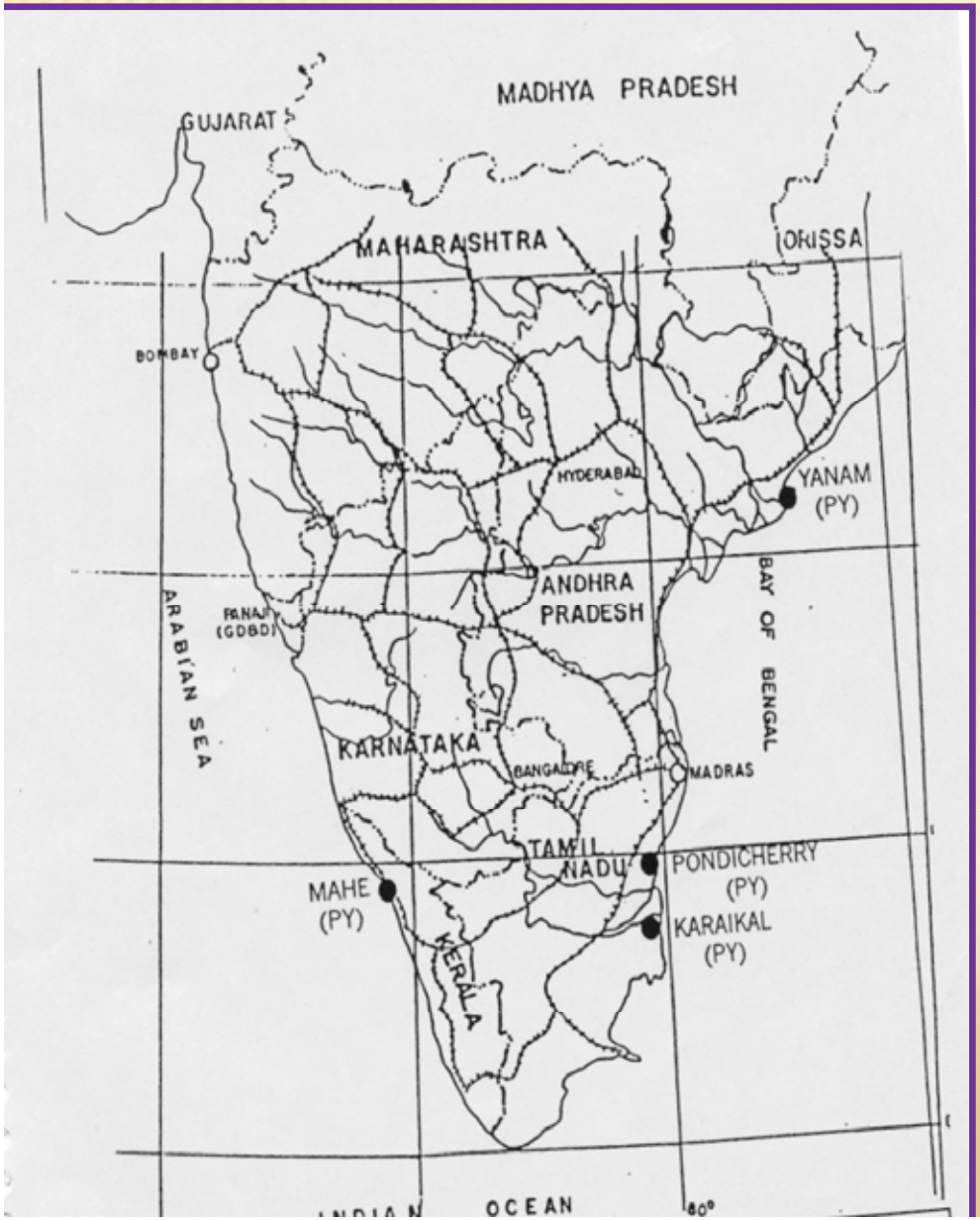
V.RADHAKRISHNAN ,Hydrogeologist –II

State Groundwater Unit & Soil Conservation

Department of Agriculture.

Puducherry

LOCATION OF REGIONS OF U.T OF PUDUCHERRY



U.T of Puducherry Comprises of 4 non- contiguous regions with a total area of 492 Sq. Kms

a) Pondicherry 293 Sq. Kms

b) Karaikal 160 Sq. Kms

c) Yanam 30 Sq. Kms lying on East Coramandal coast and

d) Mahe 9 Sq. Kms lying on West Malabar coast

AVERAGE ANNUAL RAINFALL

1. Puducherry - 1336.mm

2.Karaikal -1200 mm

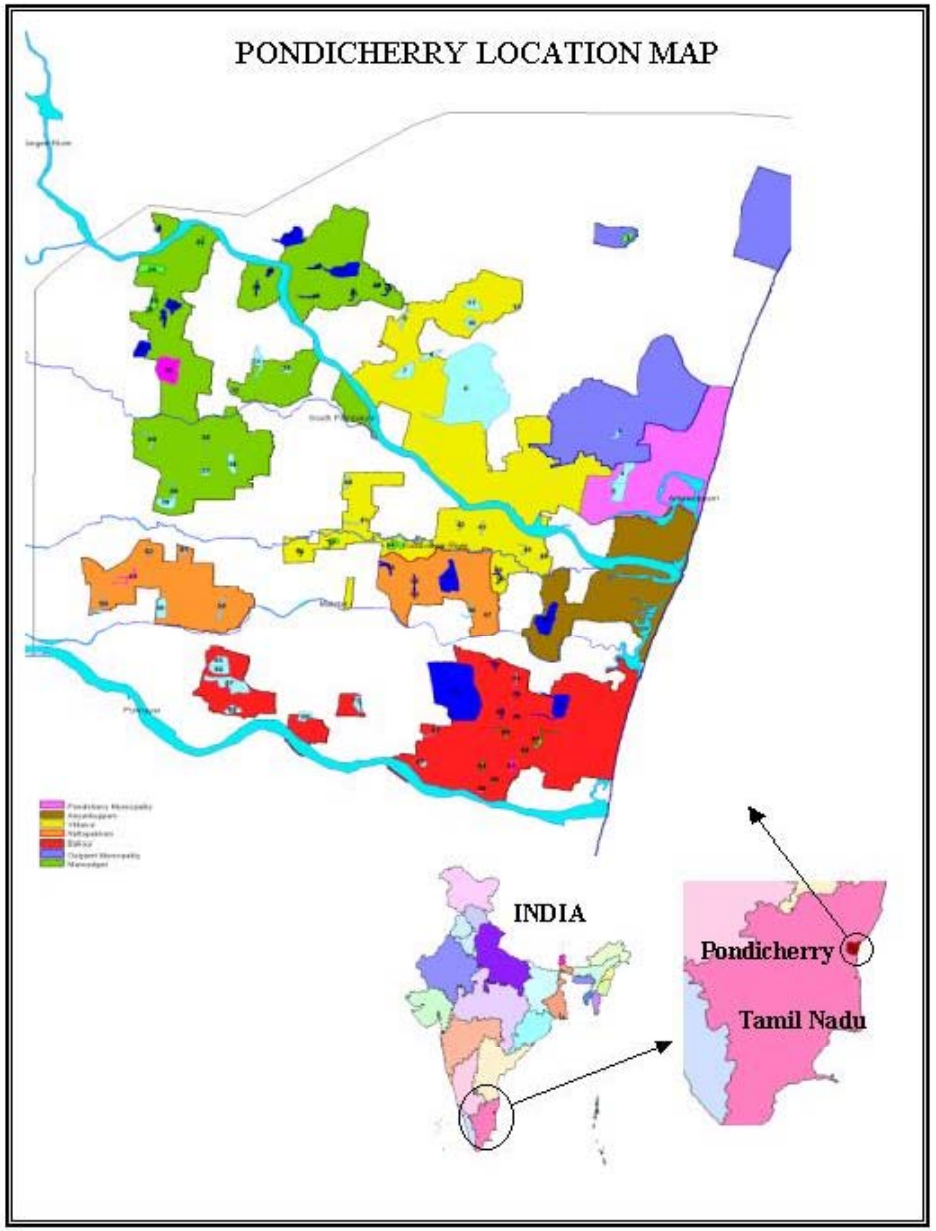
3.Mahe - 3300 mm

4. Yanam -1200 mm

PER CAPITA AVAILABILITY OF WATER IN THE U.T OF PUDUCHERRY

Year	Water in Cu.Mts
1901	1960
1991	600
2025	224 (Projected)

GEOGRAPHIC LOCATION OF PUDUCHERRY



Longitude : 79 58”.00 to 79 80” 50

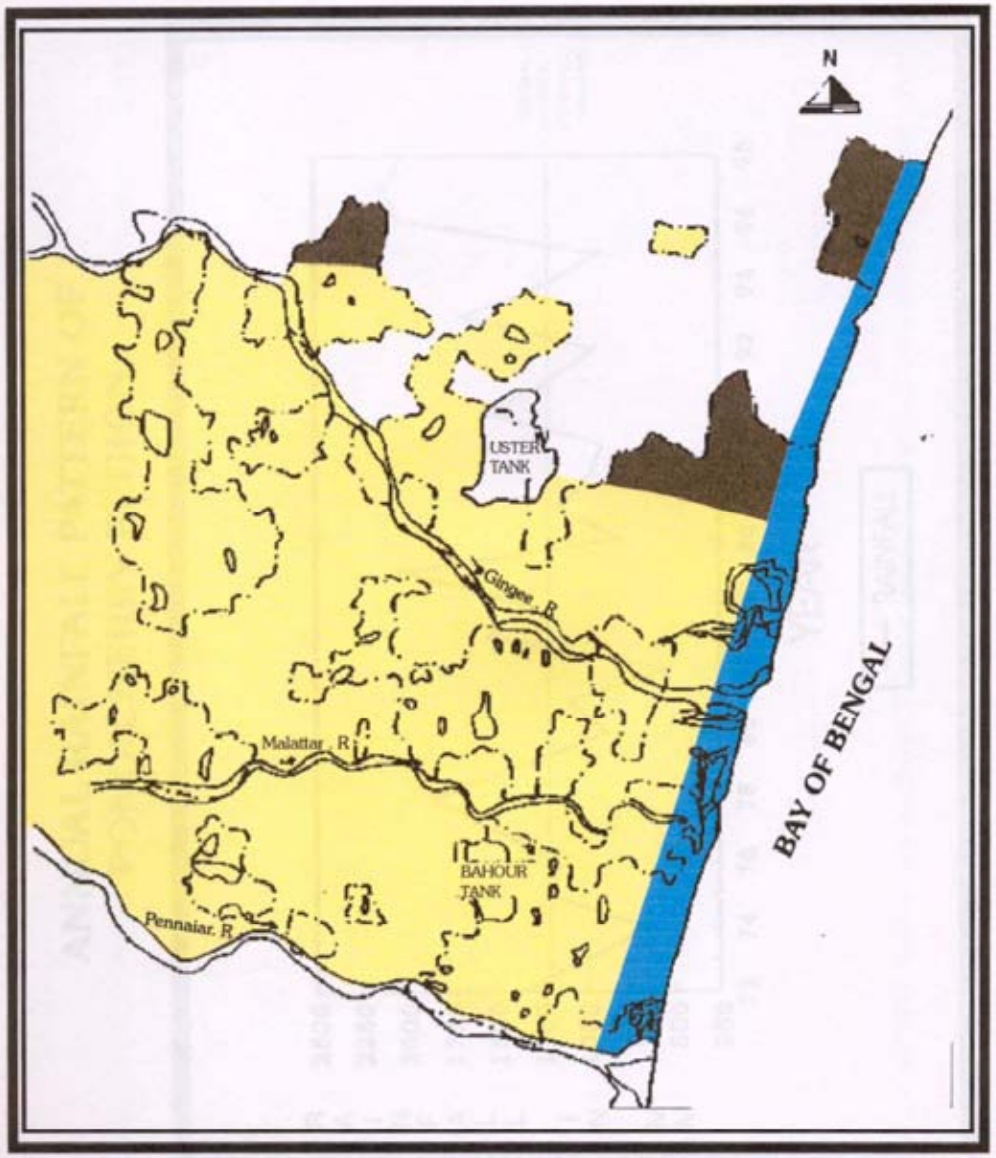
Latitude : 11 75” 00 to 12 00” 00

SALIENT FEATURES OF WATER RESOURCES ENVIRONMENT OF PUDUCHERRY.

- The scientists of CGWB, who undertook the first Exploration survey in Puducherry during the year of 1973 – 1976, reported that the conditions of groundwater in Puducherry are under prolific condition in the Indian sub Continent.

- Puducherry is bounded by two seasonal rivers and has 86 nos. of system and non system tanks, in addition to around 500 nos. of small water bodies with three different physiographic units, which provide natural recharge to the aquifers, which is a natural gift to Puducherry.

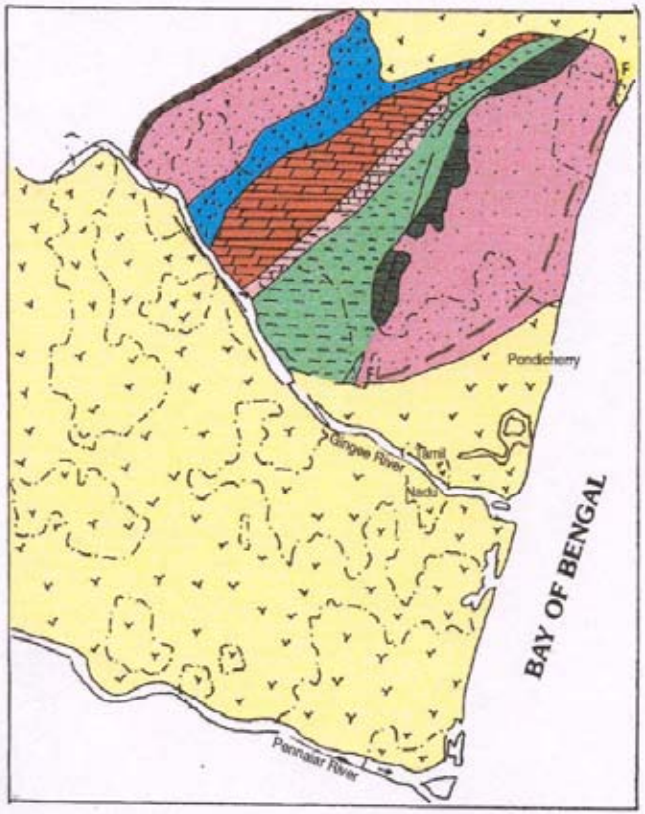
PHYSIOGRAPHY OF PONDICHERRY REGION



LEGEND

- COASTAL PLAIN
- ALLUVIAL PLAIN
- UPLANDS

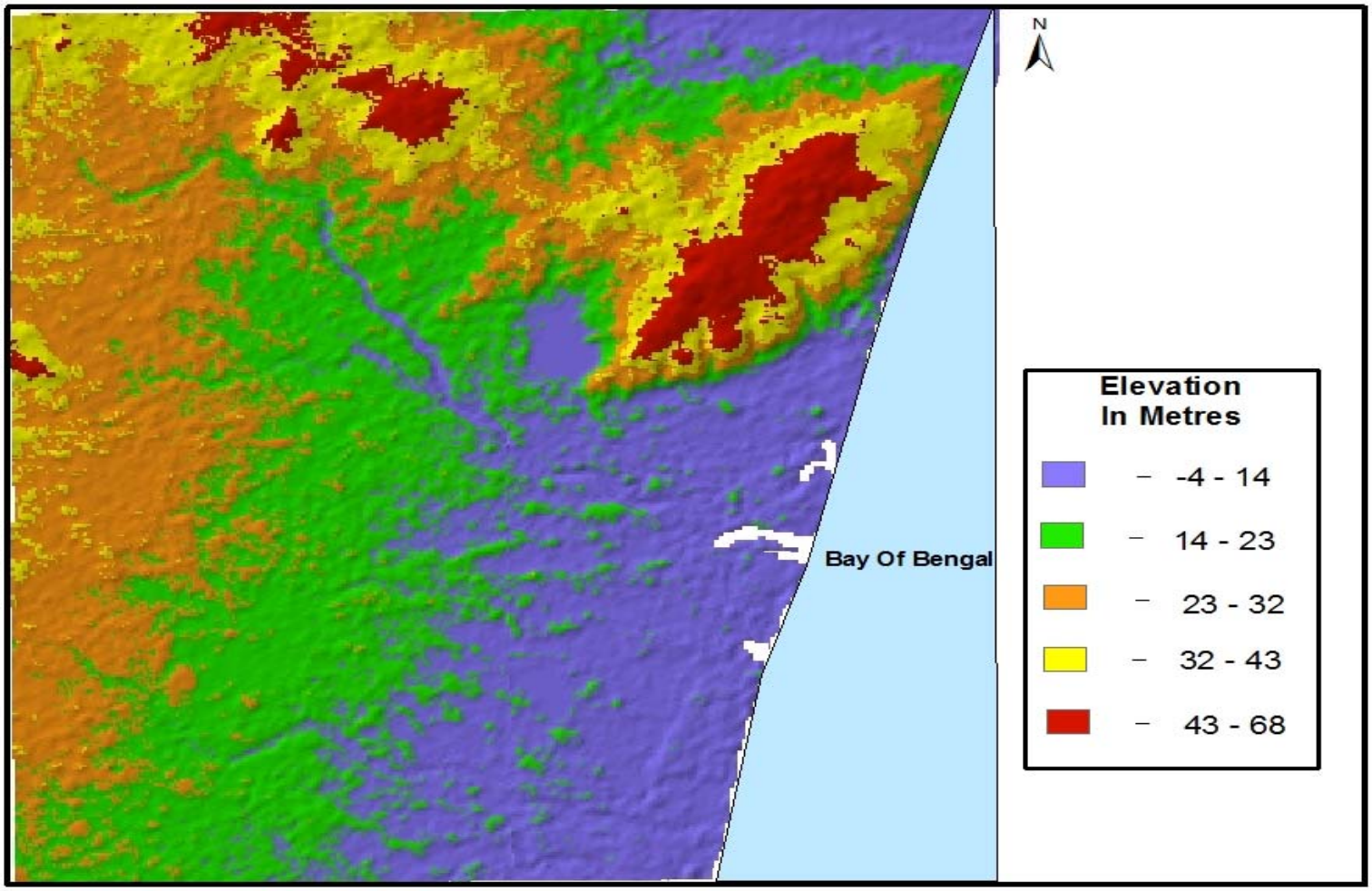
GEOLOGICAL MAP OF PONDICHERRY REGION



LEGEND

	ALLUVIUM	RECENT
	CUDDALORE FORMATION	MIO-PLIOCENE
	MANAVELI FORMATION	PALAEOCENE
	KADAPERIKUPPAM FORMATION	
	TURUVAI LIMESTONE	UPPER CRETACEOUS
	OTTAI CLAYSTONE	
	VANUR SANDSTONE	
	CHARNOCKITE	ARCHAEAN
F - - F	INFERRED FAULT	

DIGITAL ELEVATION MODEL (DEM) - PUDUCHERRY



SOURCE: SRTM (Version 4)

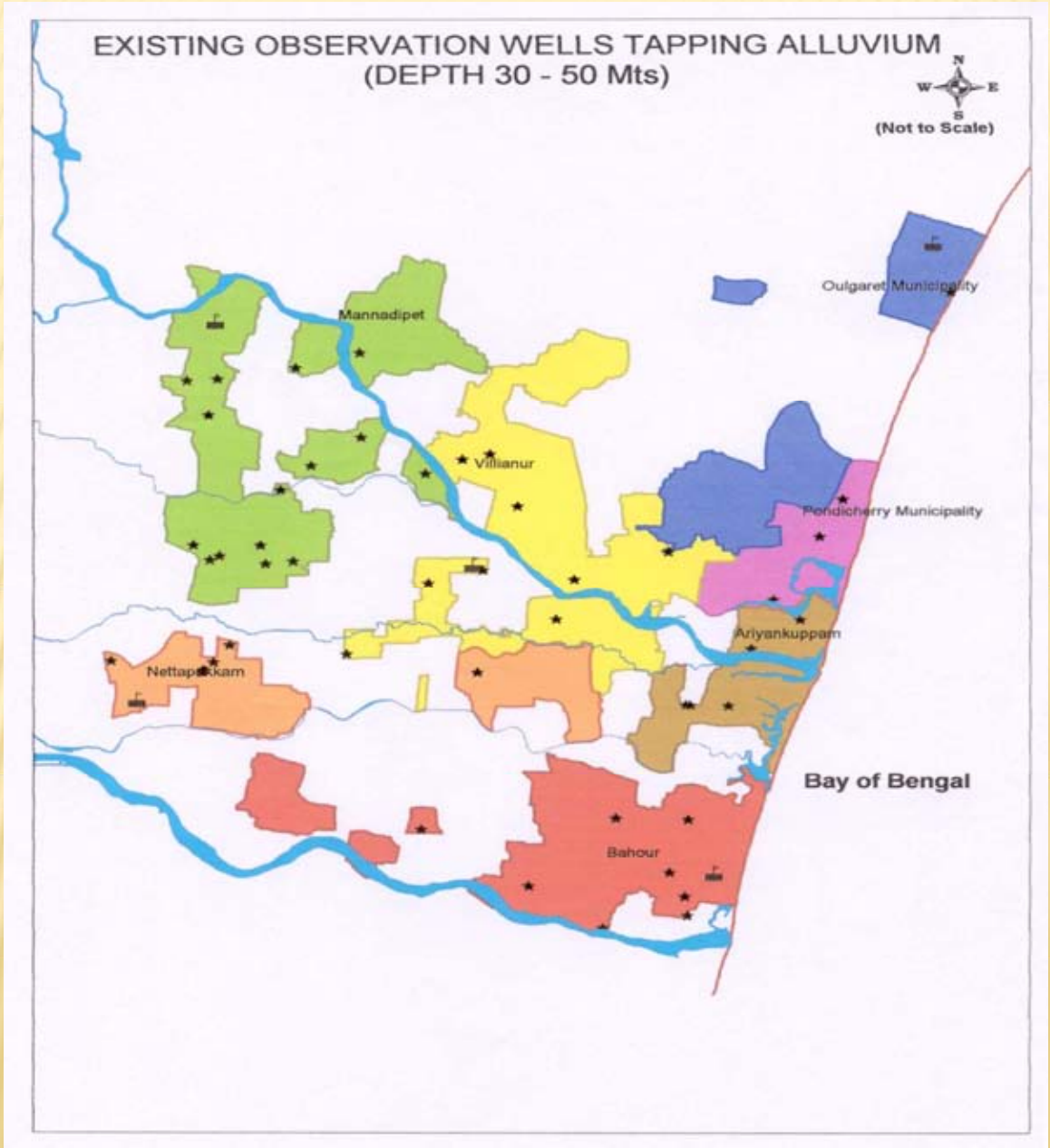
- Generally, the gradient of land is dipping towards easterly direction (Towards sea) and the movement of groundwater is towards eastern direction.

GROUNDWATER RESOURCES

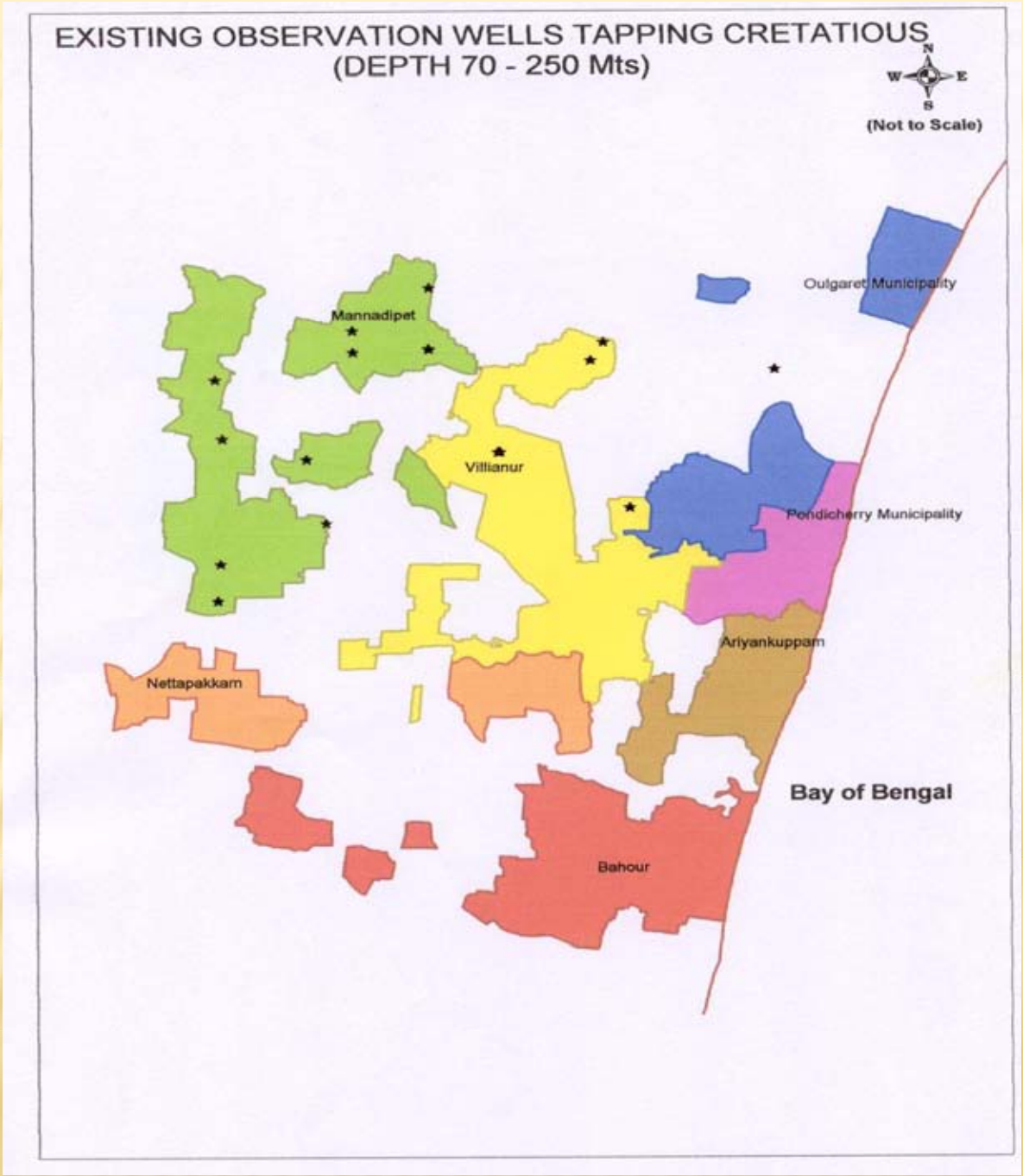
AQUIFERS CONTRIBUTING GROUNDWATER IN PUDUCHERRY

- The main aquifers that contribute groundwater in Puducherry are
  - i) Alluvial Aquifer
  - ii) Cuddalore Sandstone (Tertiary Aquifer)
  - iii) Vanur & Ramanathapuram Sandstone (Cretaceous Aquifer)

EXISTING GROUND WATER MONITORING NETWORK



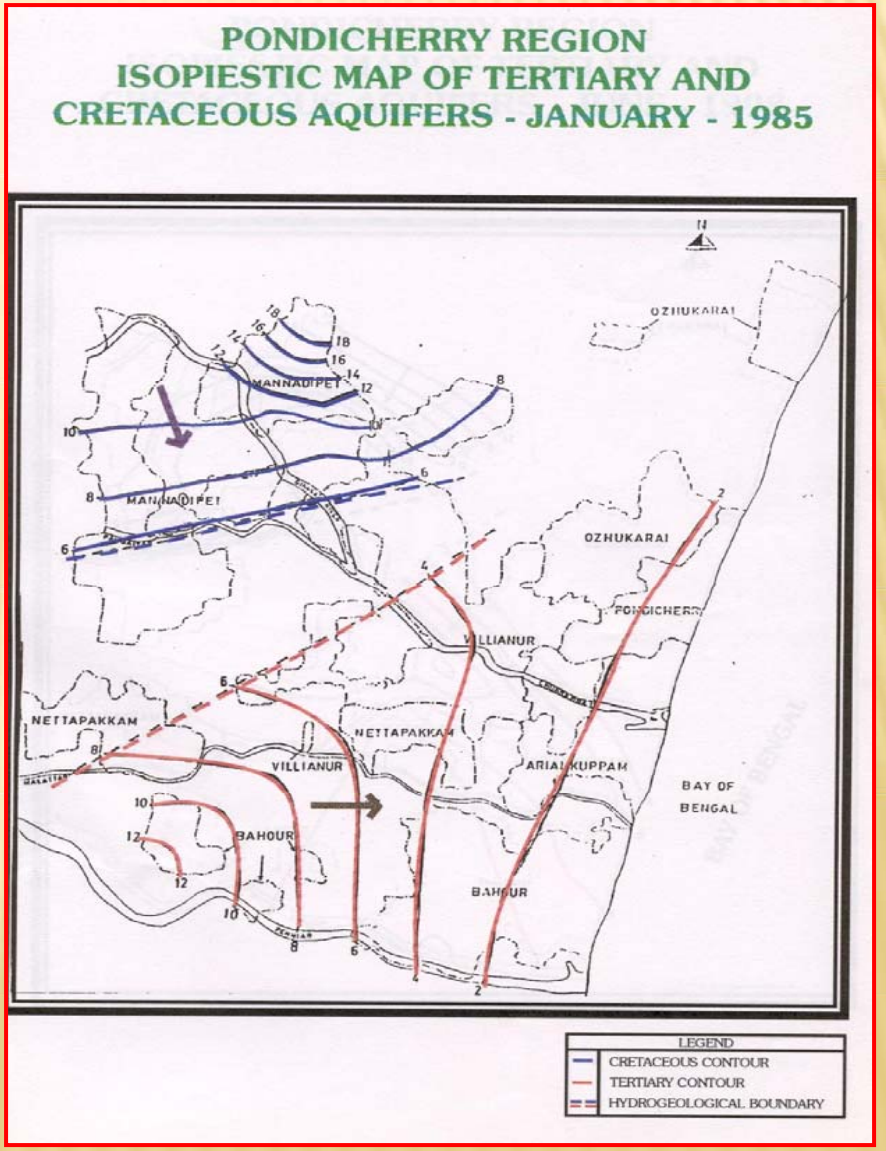

EXISTING OBSERVATION WELLS TAPPING TERTIARY
(DEPTH 35 - 200 Mts)
N
W
E
S
(Not to Scale)
Oulgaret Municipality
Mannadipet
Villianur
Pondicherry Municipality
Ariyankuppam
Nettapakkam
Bay of Bengal
Bahour


EXISTING OBSERVATION WELLS TAPPING CRETATIOUS
(DEPTH 70 - 250 Mts)
N
W
E
S
(Not to Scale)
Oulgaret Municipality
Mannadipet
Villianur
Pondicherry Municipality
Ariyankuppam
Nettapakkam
Bay of Bengal
Bahour

STATUS OF GROUNDWATER IN PUDUCHERRY

STATUS OF GROUNDWTAER IN THE EARLY 1980'S

- The groundwater was under artesian condition.
- The hydraulic gradient was under normal condition and the flow was towards Eastern direction (i.e. Sea side).
- The water levels in all areas were above Mean Sea Level.



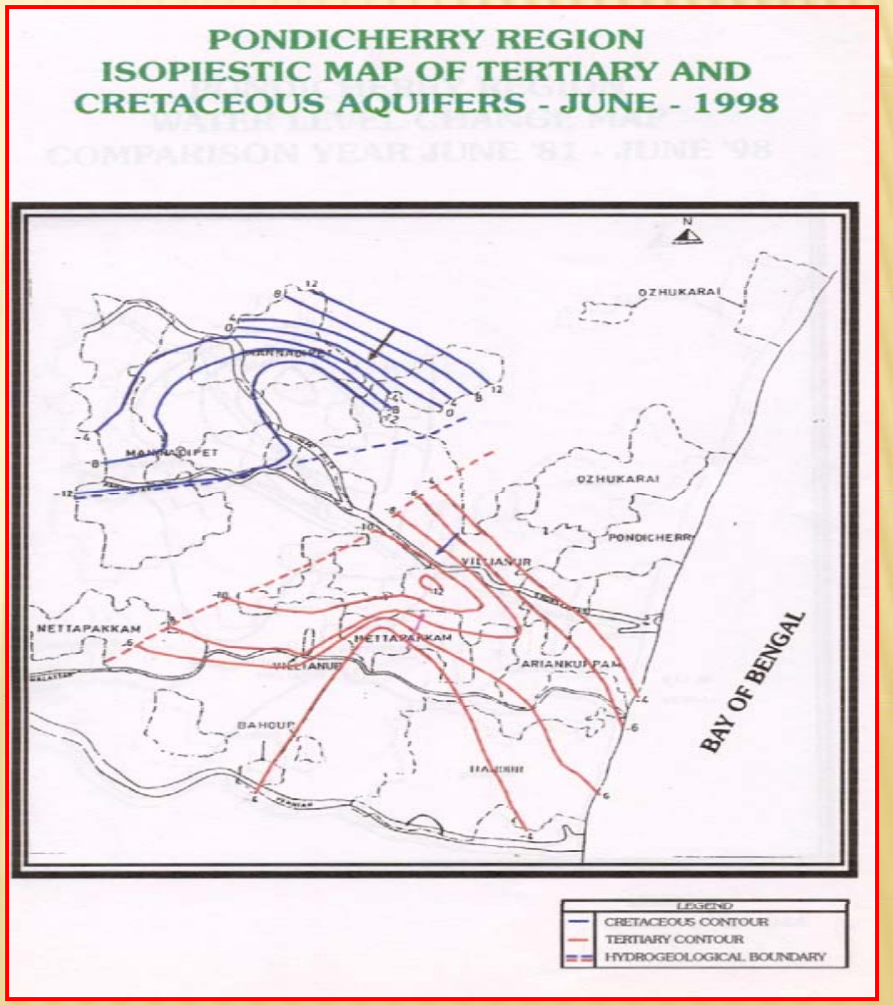
STATUS OF GROUNDWATER AFTER 1985

The groundwater levels in most of the areas have started declining below MSL., and the Hydraulic gradient gradually started to reverse due to the following reasons:

i. Successive failure of monsoon.

ii. Neglect of surface water bodies resulted in total dependency on groundwater.

iiii. Abolishment of Syndicate Agricole and transfer of surface water bodies to local bodies resulted in improper maintenance of surface water bodies and Irrigation channels.



STATUS OF GROUNDWATER AFTER 1985 (CONT'D)

iv. Over extraction of groundwater through 6000 numbers of tubewells with submersible pump sets, due to increasing demands from all sectors (agriculture, domestic and industries) .

v. The water level has declined to a depth of 5 – 10 mts in the coastal tract, and 25 – 40 mts in the NW parts.

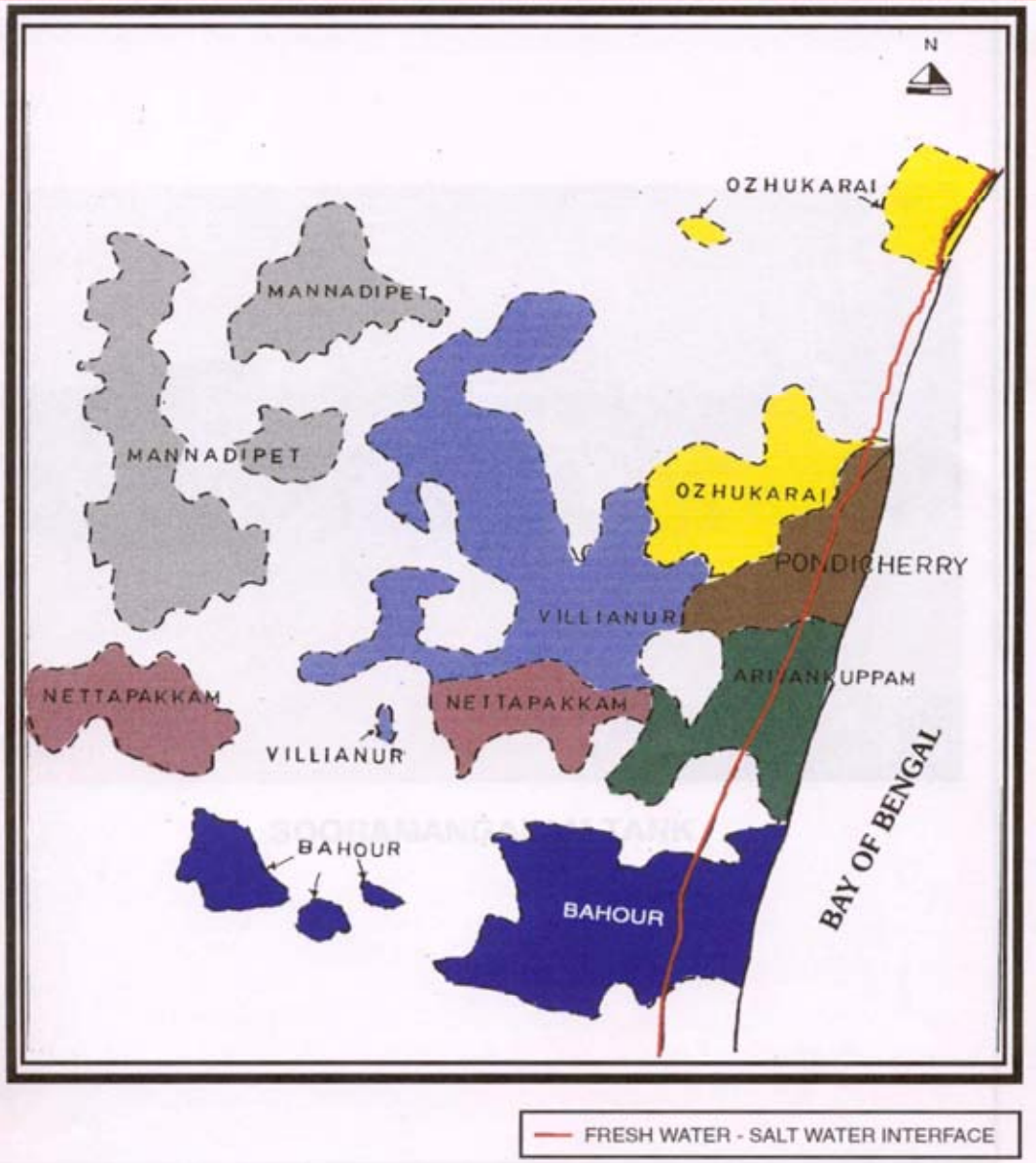
vi. Salt water intrusion along the coastal aquifer systems up to 1 TO 4 kms has resulted in the deterioration of quality of groundwater in shallow and upper part of the deeper aquifers.

vii. The TDS Content has also started to increase considerably from east to west

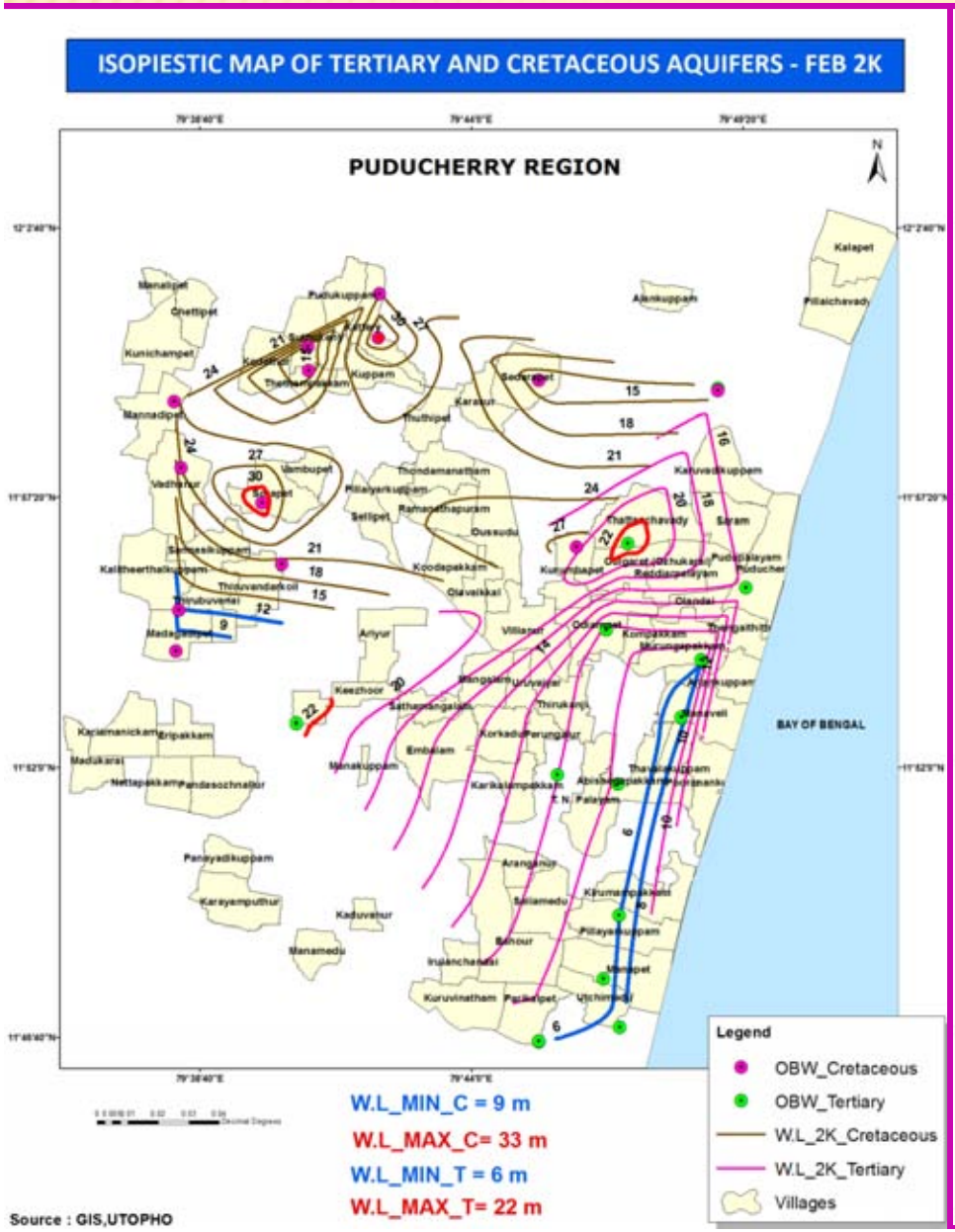
SEA WATER INTRUSION

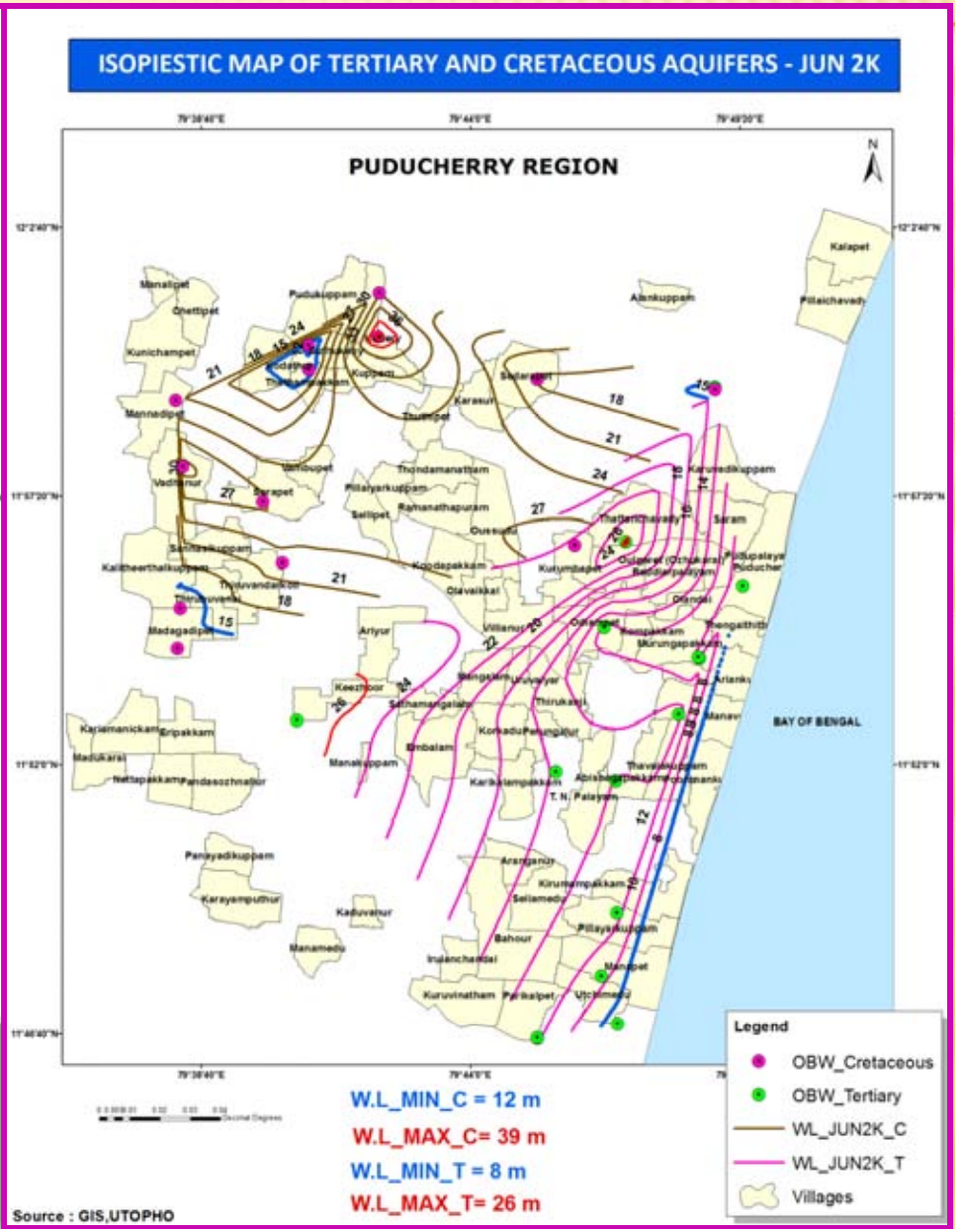
INTRUSION IS NOTICED

- **3 To 4 Kms inland in the southern parts**
- **2 Kms inland in the city**
- **1 Km inland in the northern side**



During 2000, ground water flow also experienced a reversal in gradient (towards west). Piezometric head lowered below the mean sea level in deeper aquifers



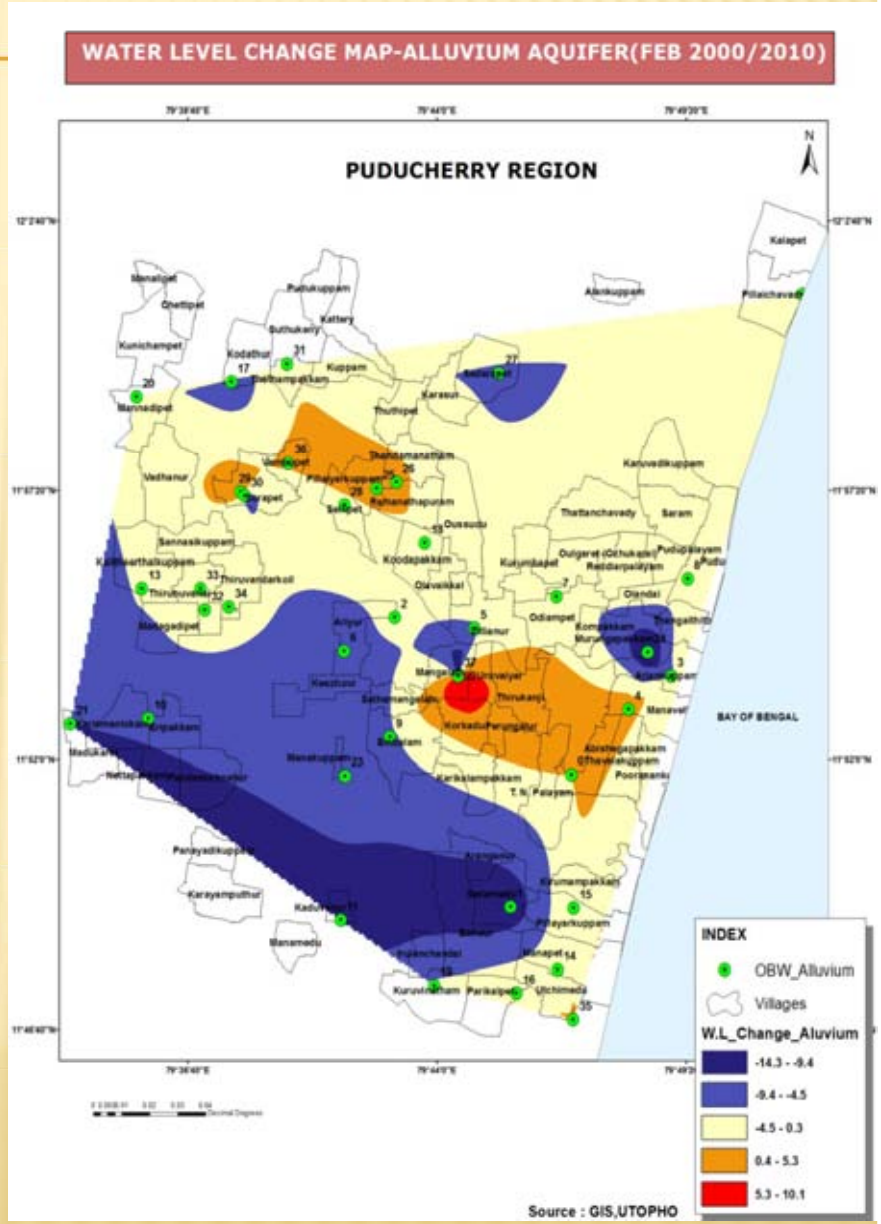


- On Comparison of water levels in the alluvial aquifers between the years 2000 and 2010, it is observed that

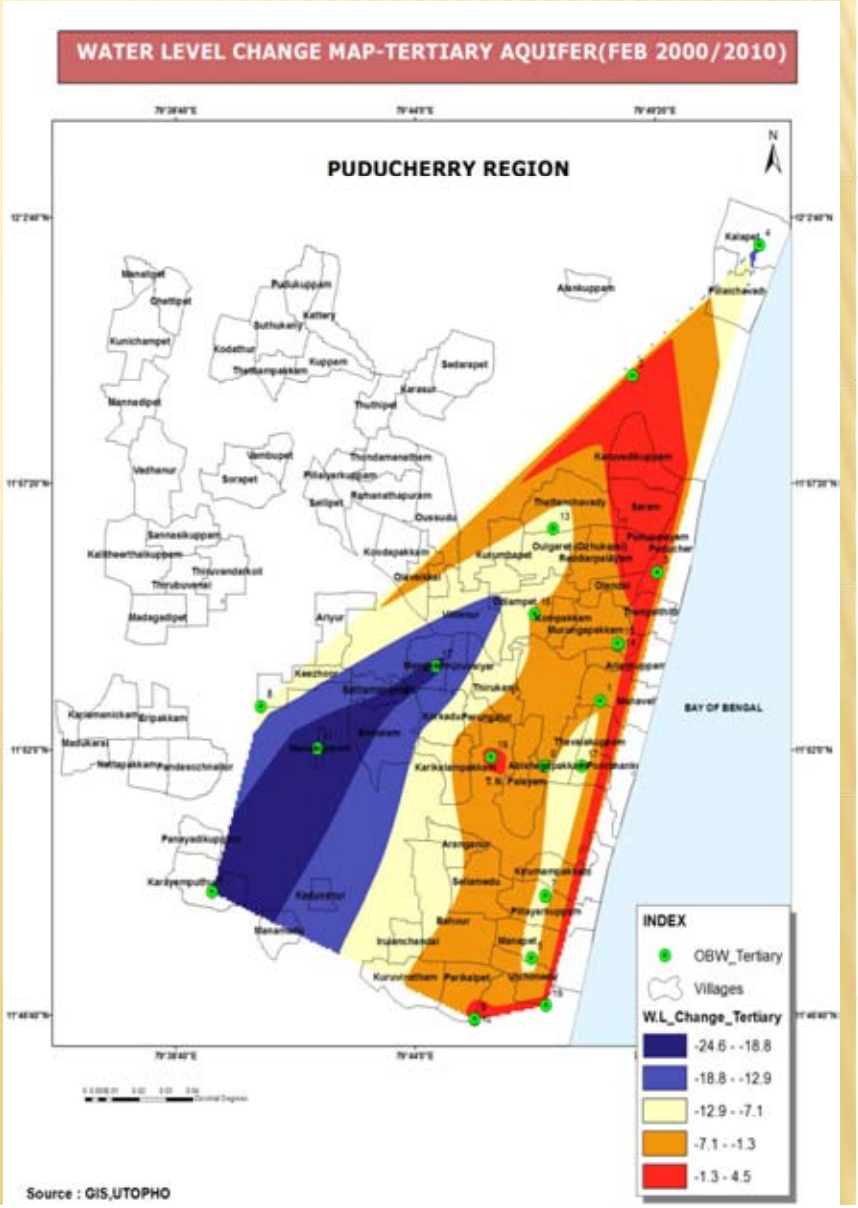
* there is a drop of 5 to 14 mts in water level

* a max. drop is observed at Central and NW parts.

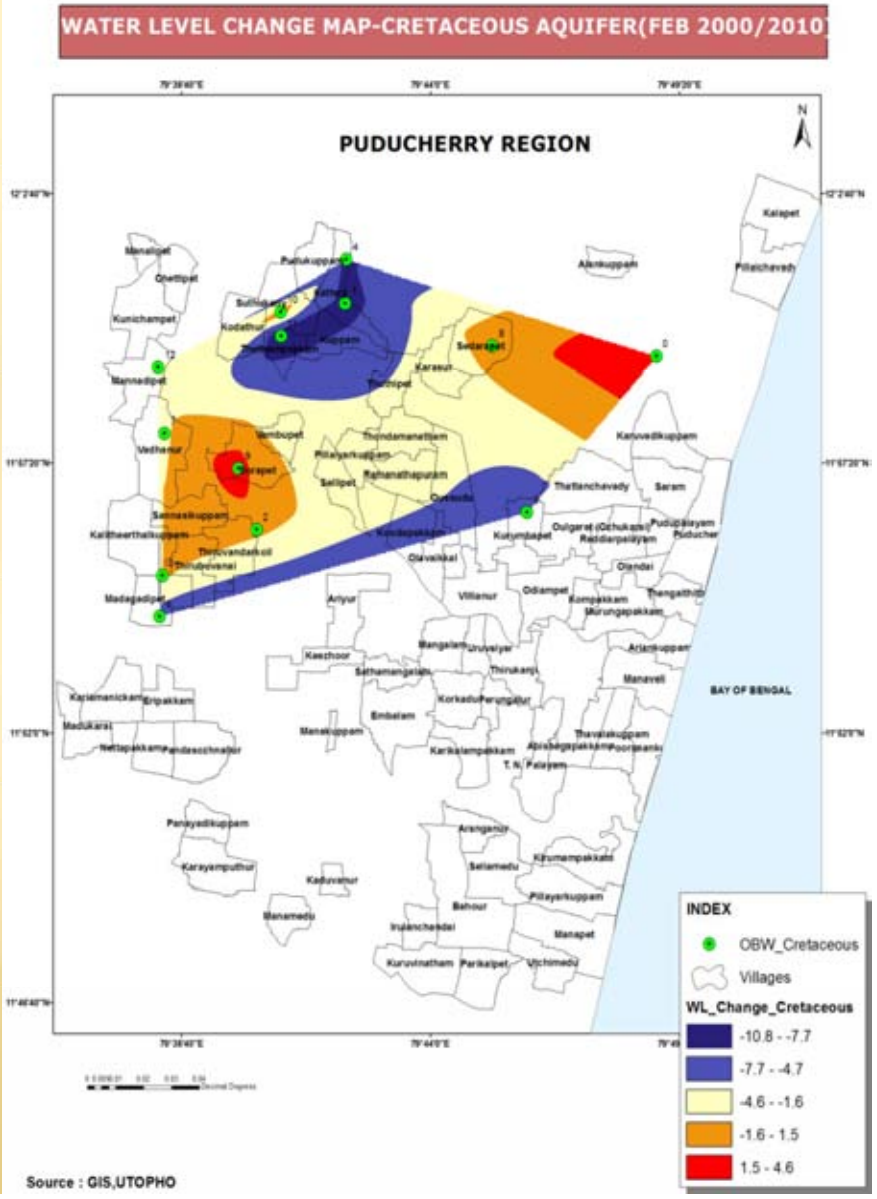
* The present water level in the NW and central parts are in the range of 25 to 35m below msl.



- Similarly, in the Tertiary aquifer, a drop of 2m to 24m is observed during the same period of 10 years. The max. drop is observed in the SW parts of Puducherry. The present Max.water level in the tertiary aquifer is 30 m bmsl.

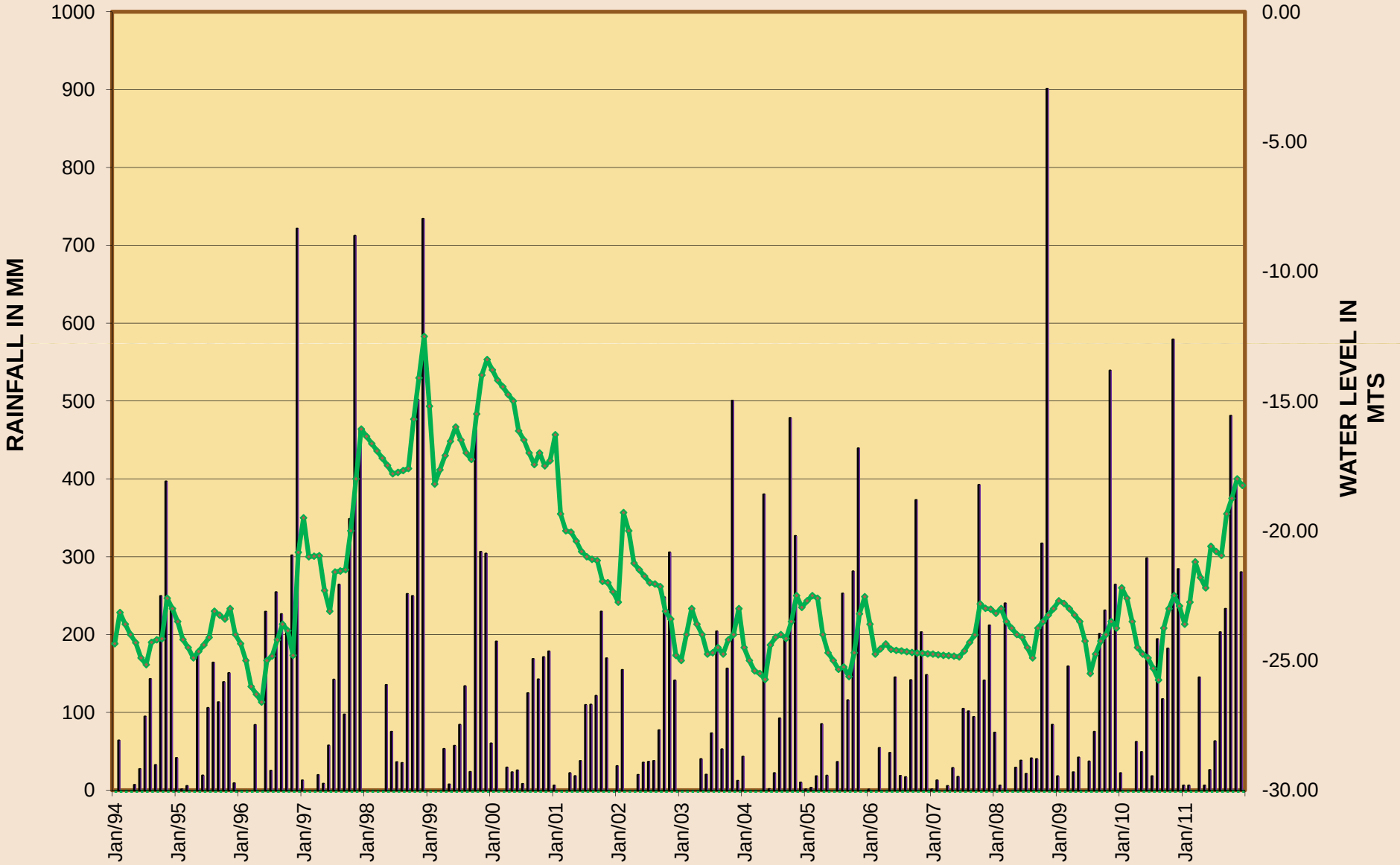


- Similarly a depletion of 2m to 10 m is observed in the Cretaceous aquifer for the same period. Max. drop is observed in NW portions of Puducherry. The present Max.WL in this area is around 55 m bmsl.

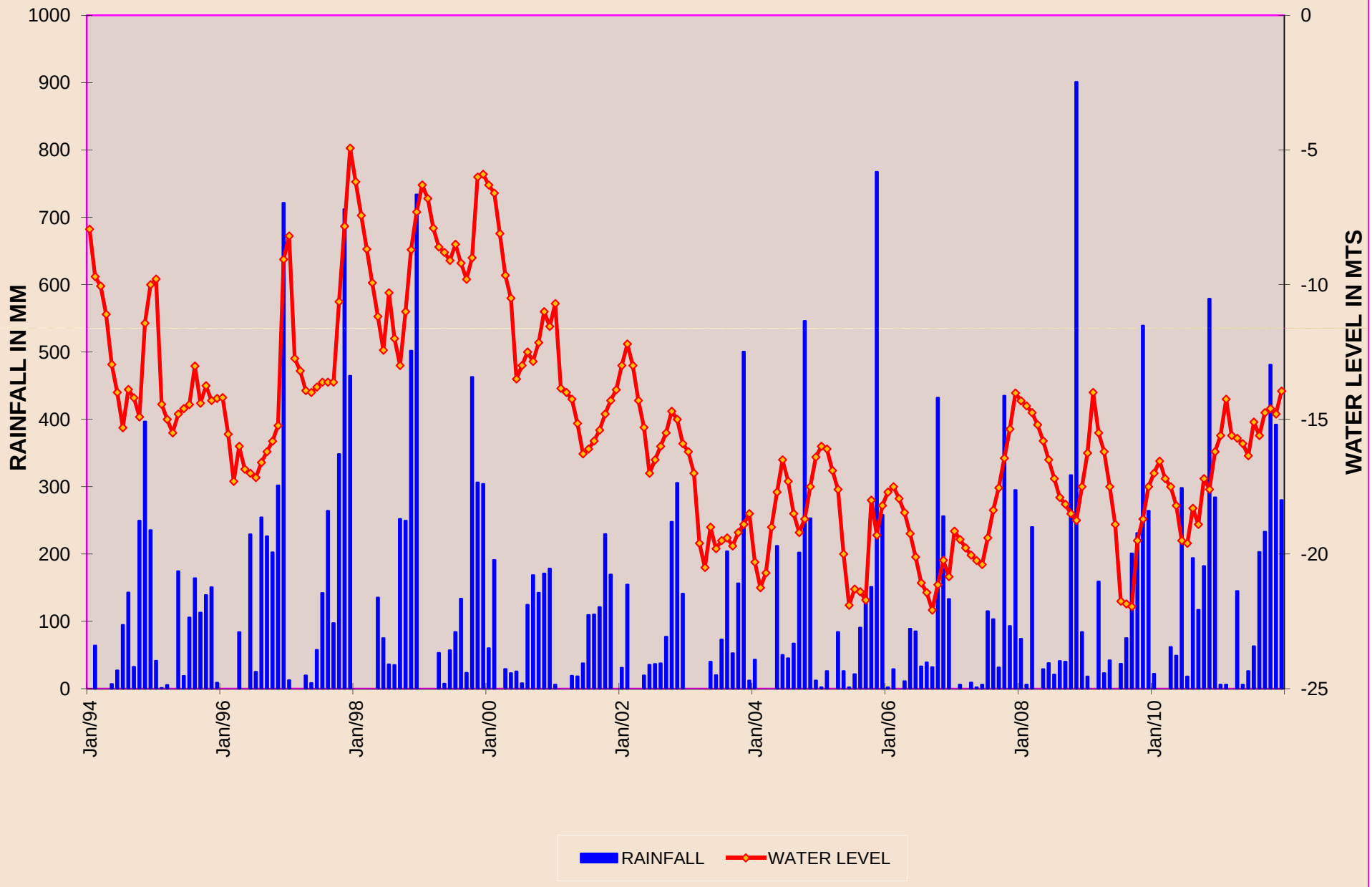


CASE STUDIES- FLUCTUATION OF WATER LEVELS

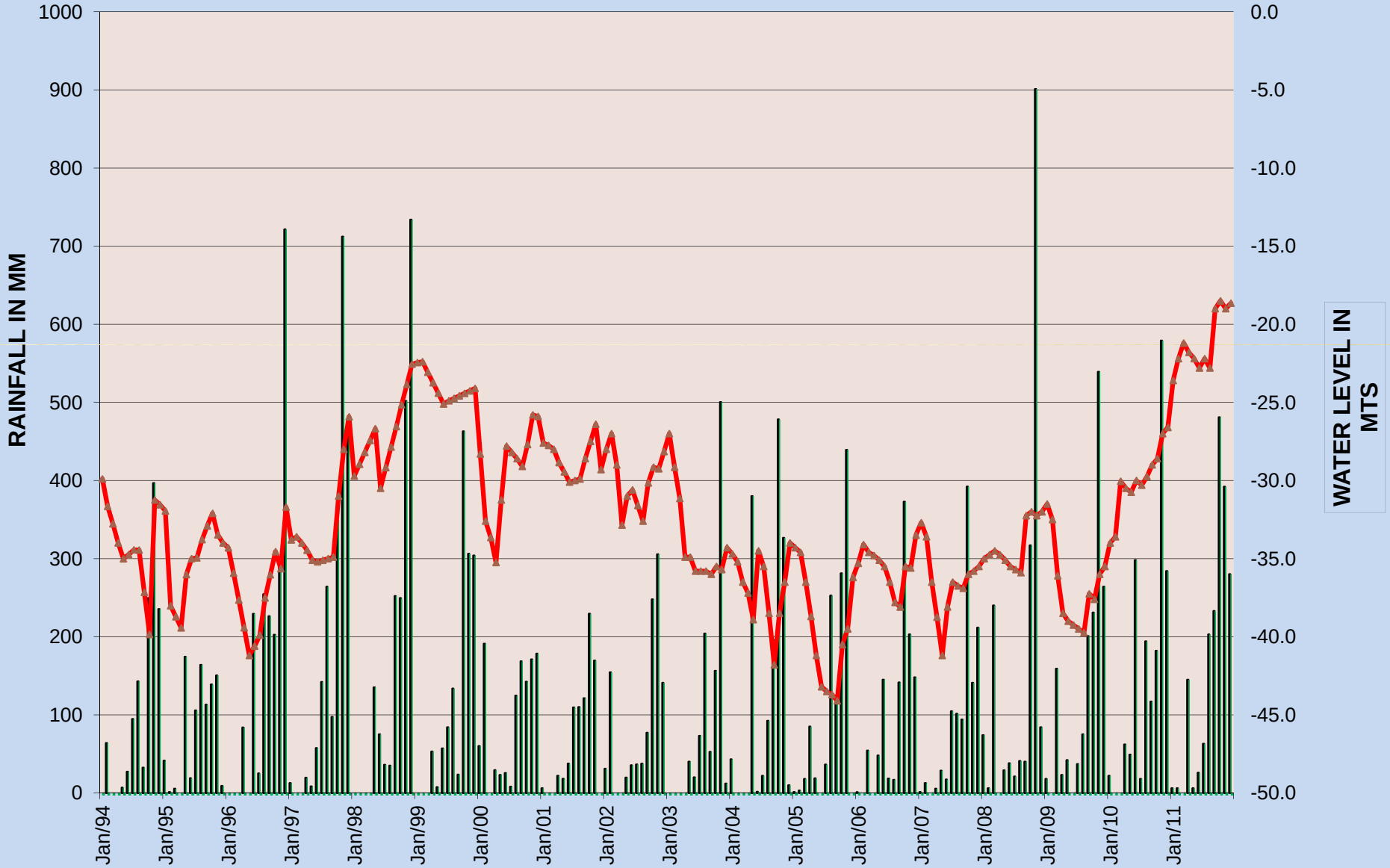
HYDROGRAPH OF MADUKARAI (ALLUVIUM)



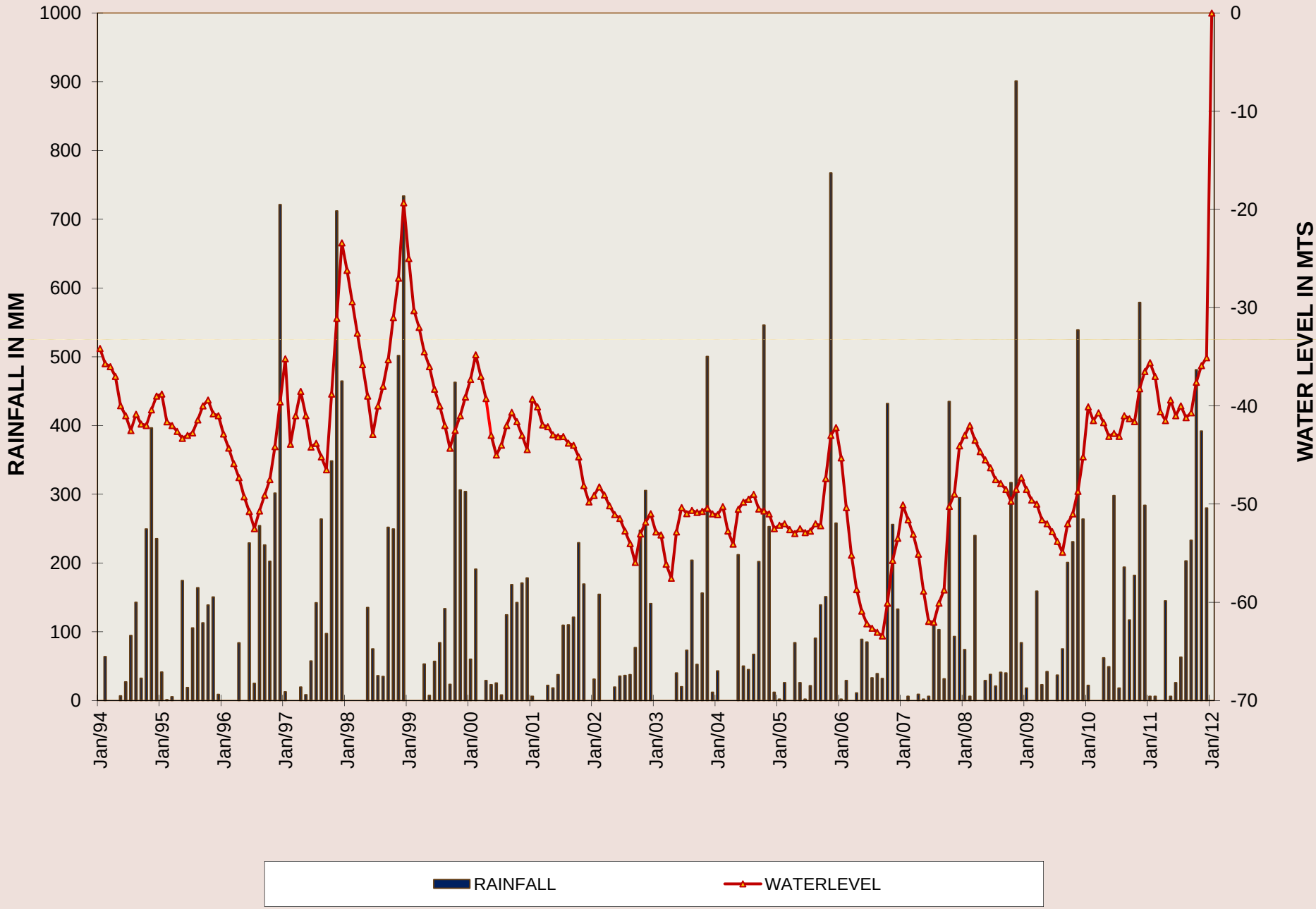
HYDROGRAPH KANNIAKOIL(C.B) (TERTIARY)



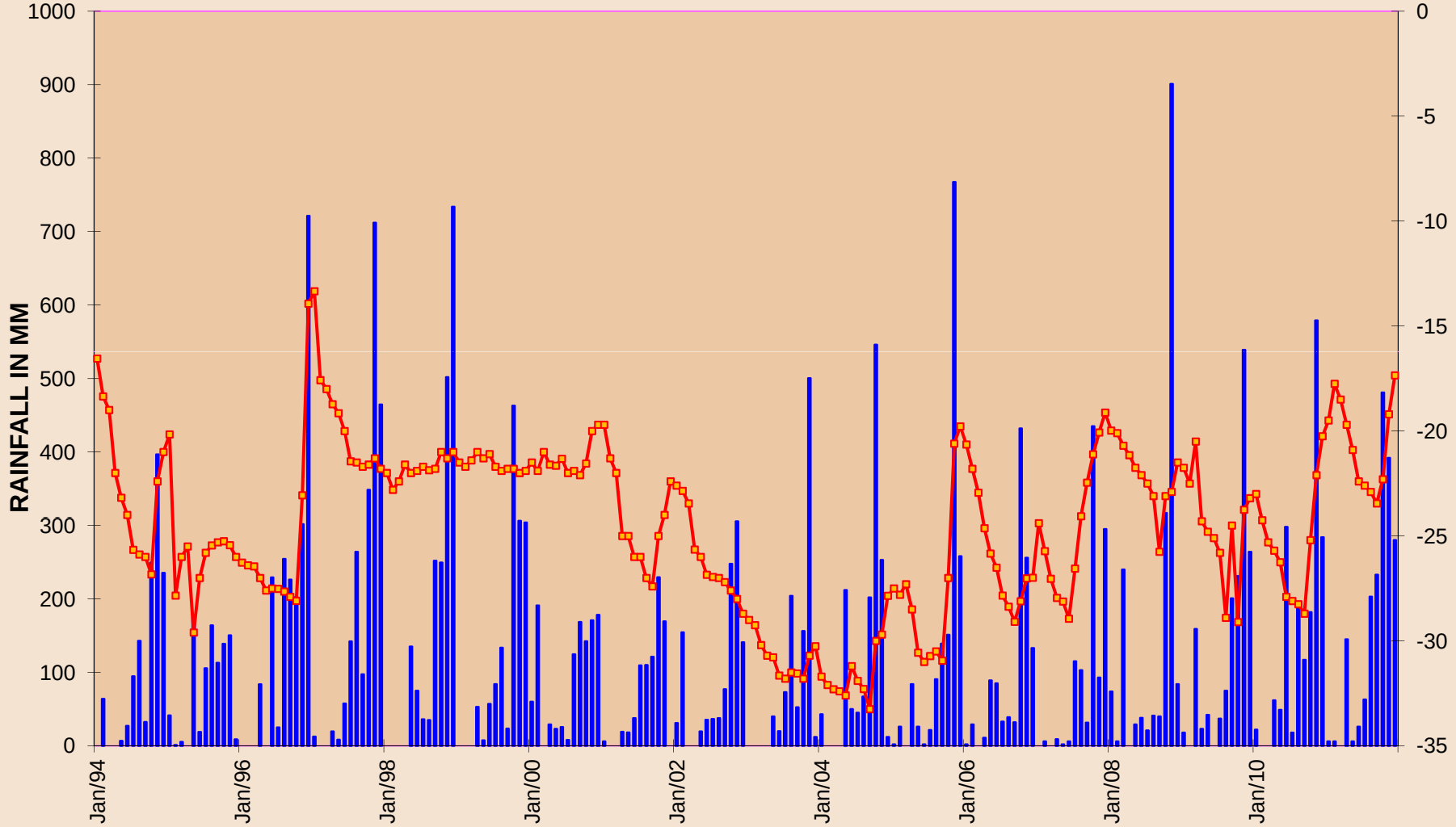
HYDROGRAPH OF SORAPET (CRETACEOUS)



HYDROGRAPH OF KATTERIKUPPAM

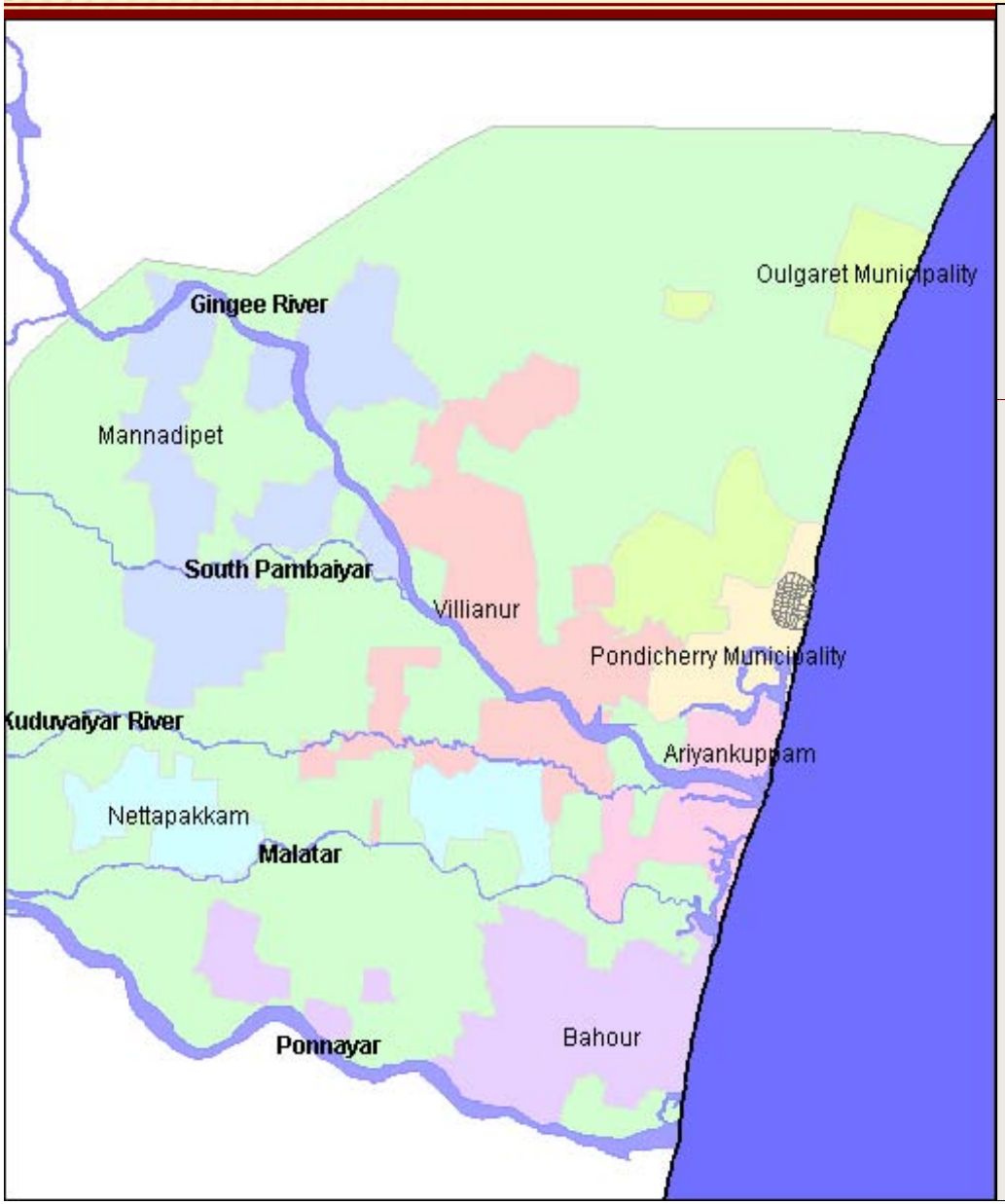


HYDROGRAPH OF KARAYAMBUTHUR



SURFACE WATER RESOURCES

EXISTING RIVER NETWORK



Length of Rivers(Seasonal Rivers)

Main rivers

Gingee River = 31 Km

Pennaiyar River = 6 Km

Branches

Guduvaiyar River = 17 Km

Pambaiyar = 13 Km

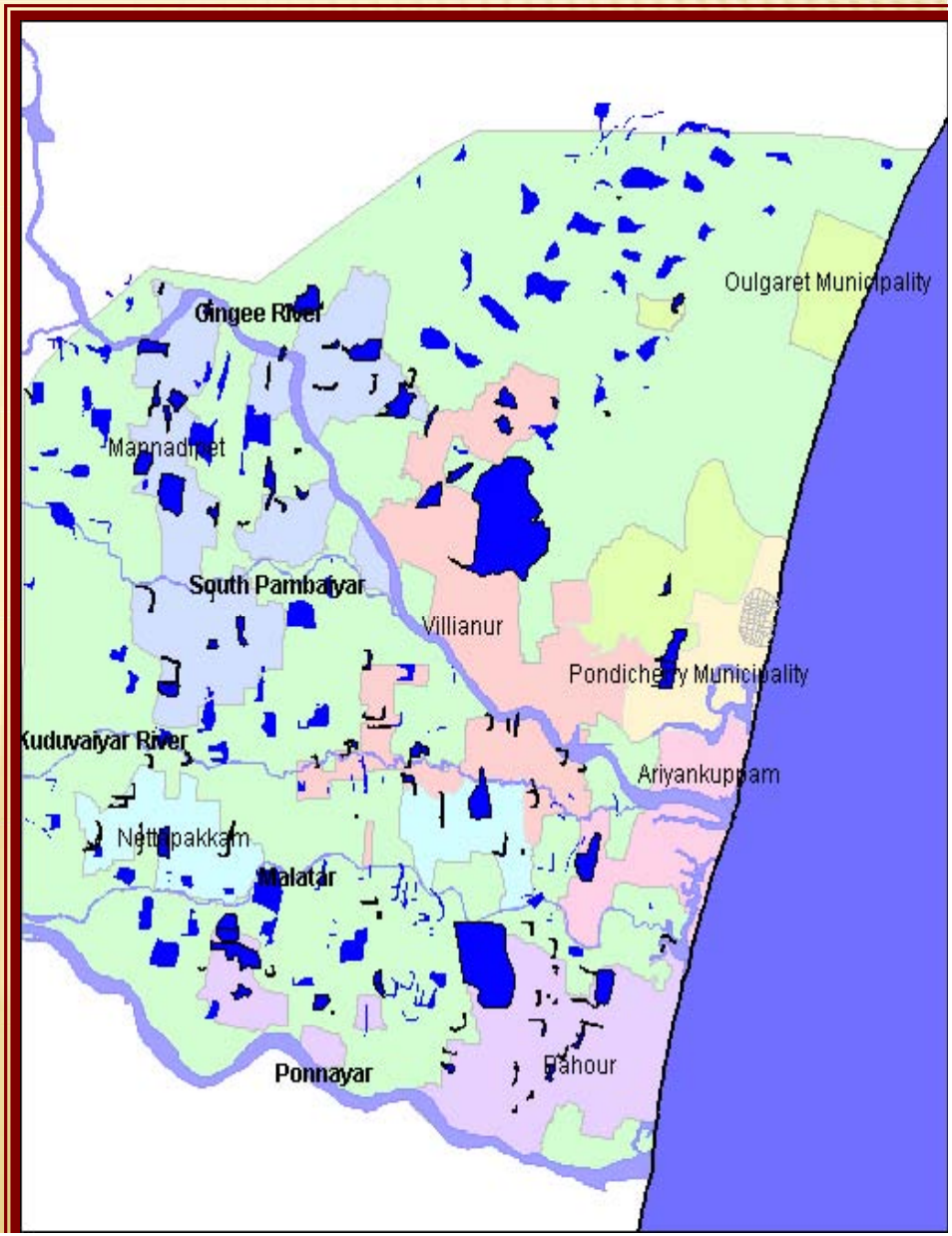
Malatar = 13 Km.

------

65 Km

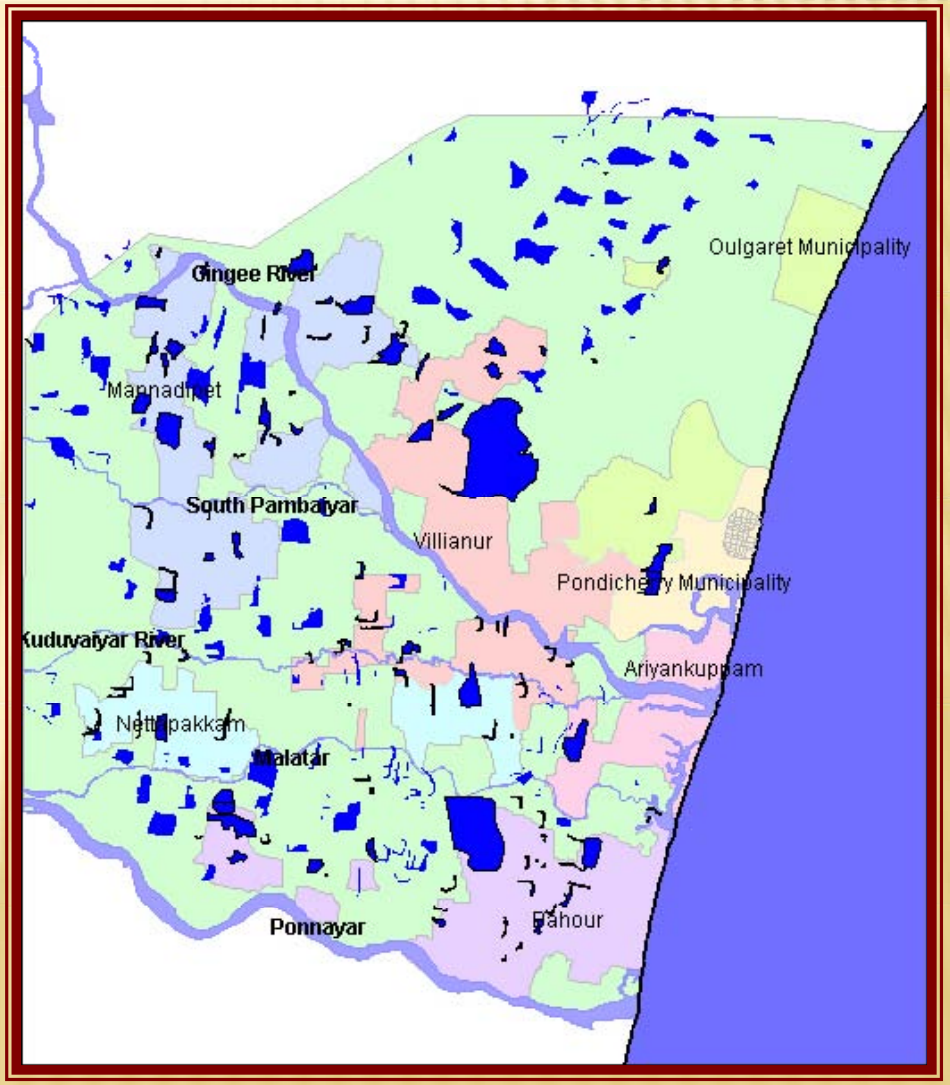
Network of system and non-system tanks (Surface water bodies)

- 84 nos. of tanks available at present of which 50% are system tanks and 50% are non-system tanks.

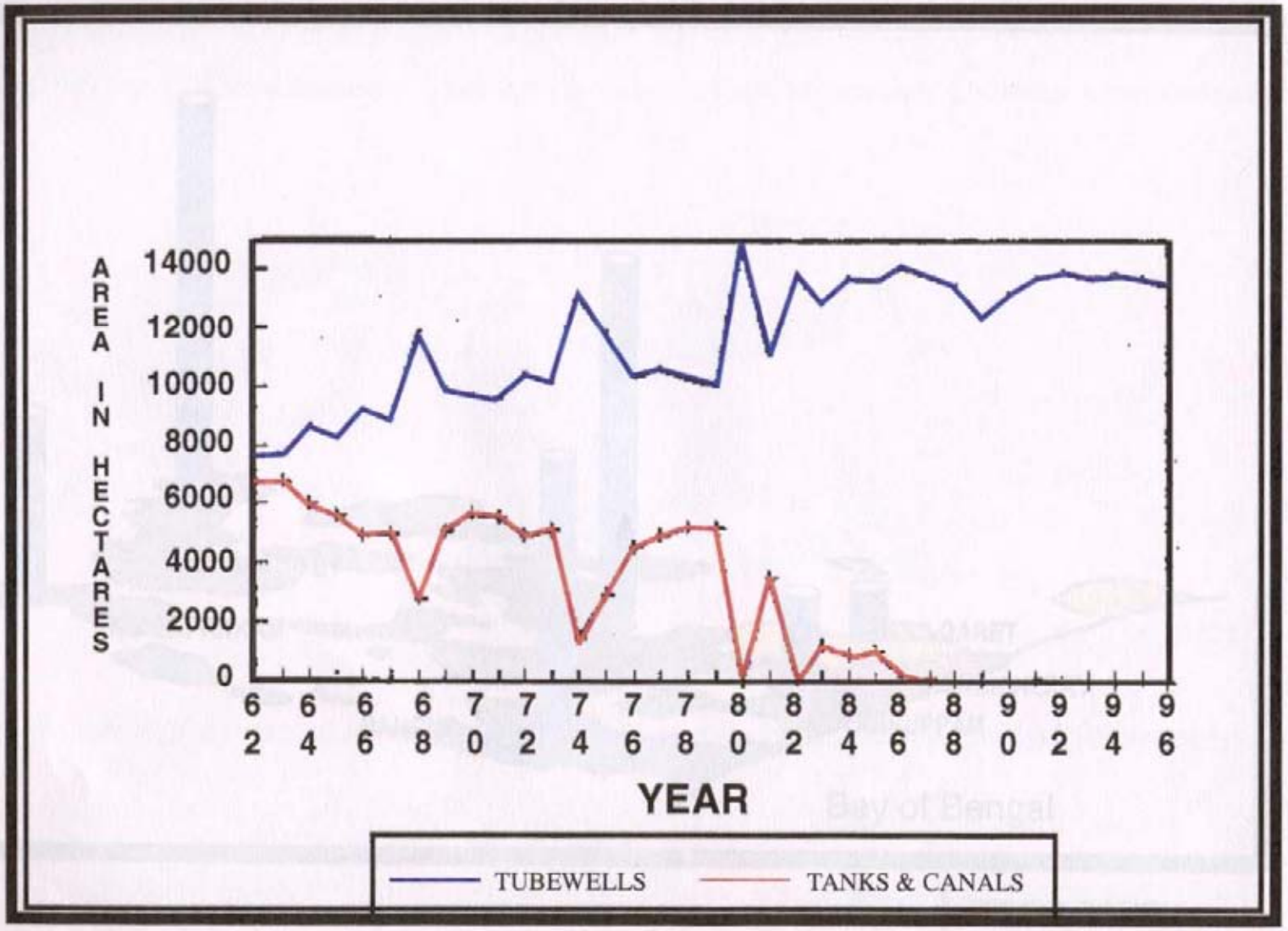


STATUS OF CONJUNCTIVE USE OF SURFACE WATER AND GROUND WATER FOR IRRIGATION IN PONDICHERRY REGION

- Irrigation in Puducherry was mainly carried out through 84 nos. of Tanks and supplemented by around 3000 shallow tube wells fitted with Centrifugal Pumps.
- The Operation and maintenance of the tanks and water courses were looked after by an elected body of local farmers(Syndicate Agricole) and were effectively functioning.



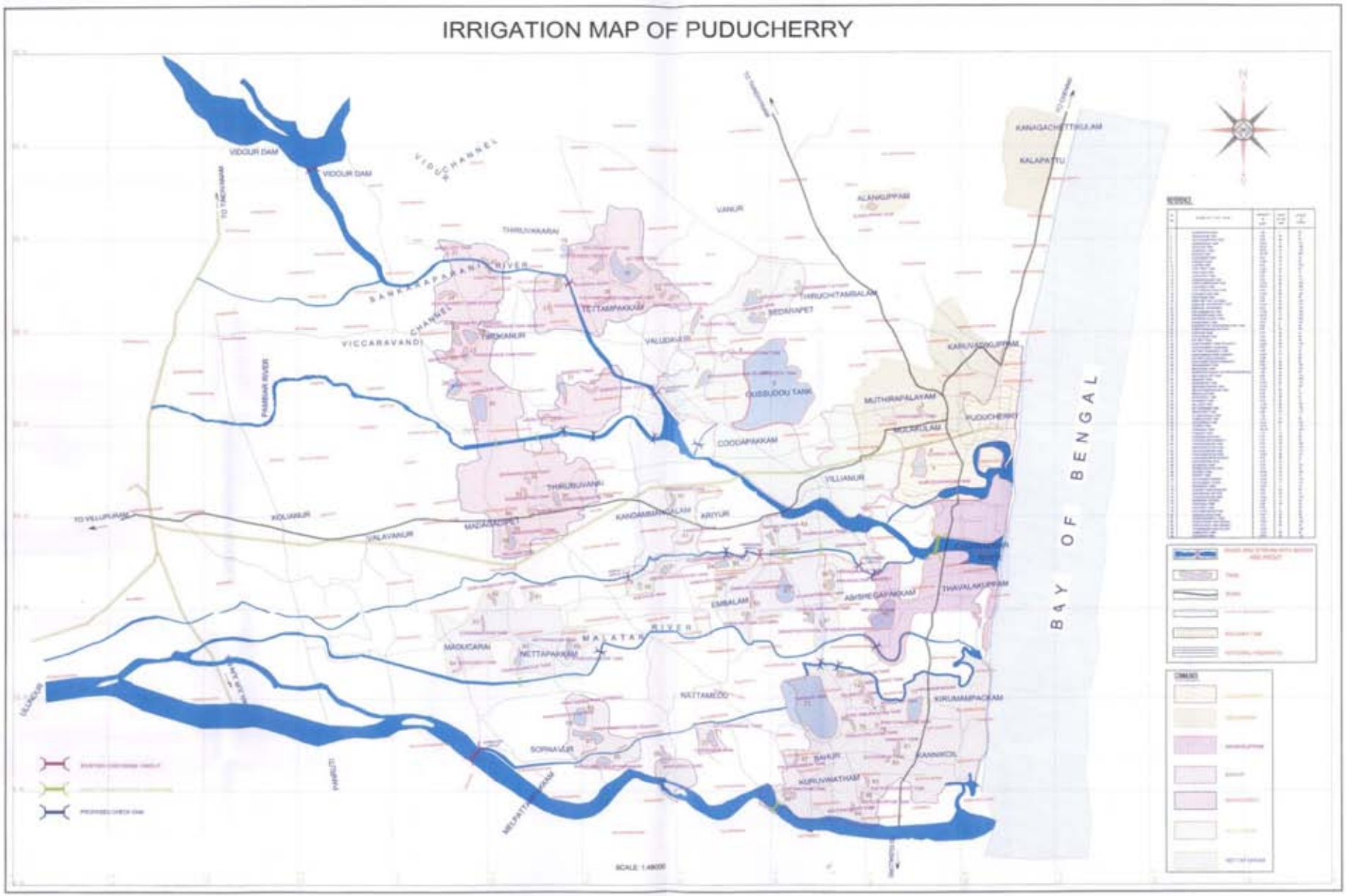
AREA IRRIGATED BY TANKS AND CANALS (SURFACE WATER) AND TUBEWELLS (GW)



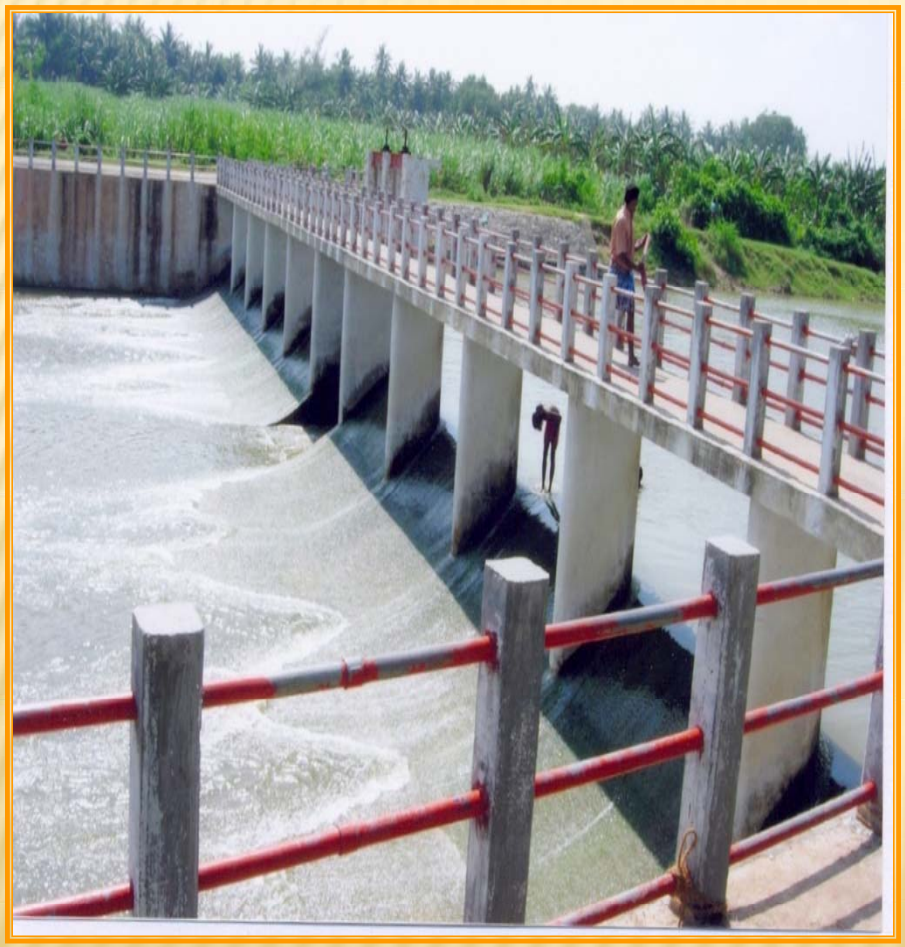
DETAILS OF CHECK DAMS CONSTRUCTED IN PONDICHERRY TO IMPROVE THE GROUNDWATER POTENTIAL

- 24 numbers of check dams have been constructed across the river courses to impound the water for augmenting groundwater potential and construction of 11 nos. of check dams is under progress.
- The details of the check dams constructed are as follows:

EXISTING CHECK DAMS IN PONDICHERRY REGION.



CHECK DAM ACROSS SOUTH PAMBAIYAR RIVER AT SILKARIPALAYAM IN MANNADIPET COMMUNE



- A bed dam has been constructed during the year 2003 at a cost of Rs.59.29 lakhs. By construction of the bed dam, water has been stored in the upstream side for the purpose of increasing the ground water potential.

A BARRAGE WITH TWO LANE BRIDGE IN URUVAIYAR AND VILLIANUR ACROSS SANKARAPARANI RIVER AT VILLIANUR.

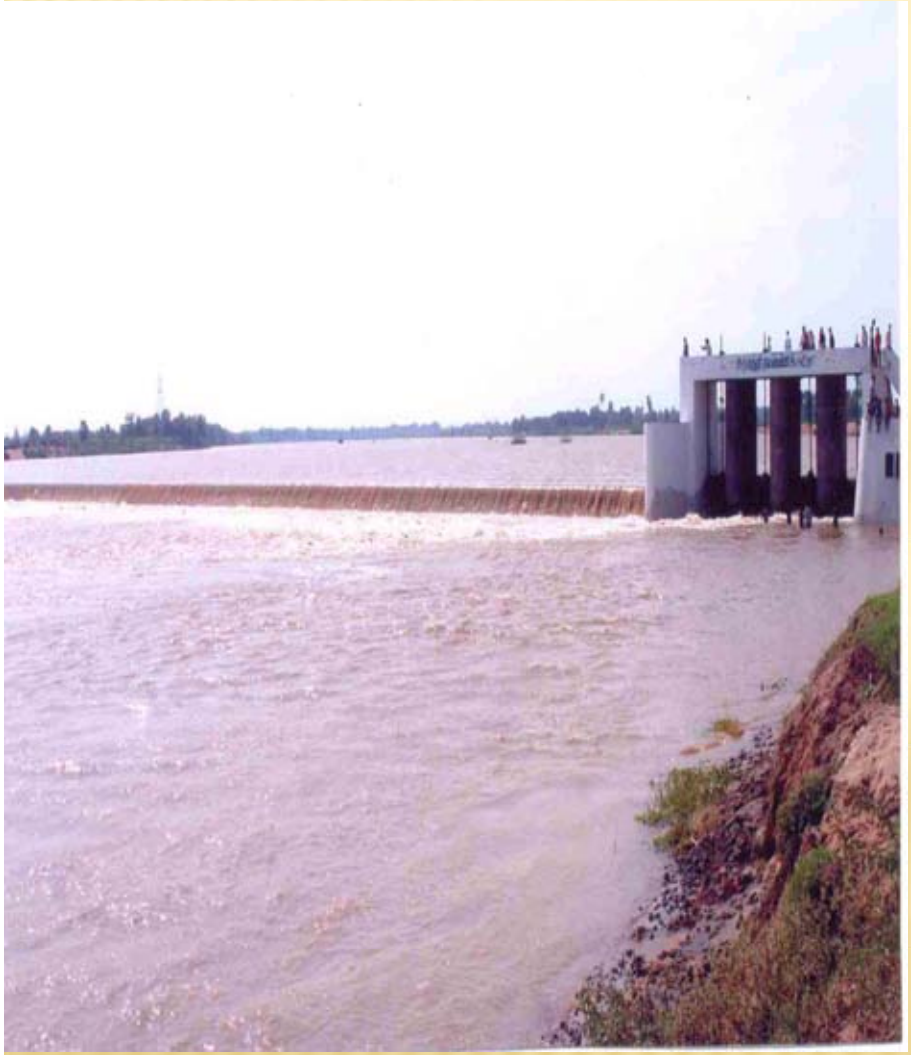
- A high level bridge cum barrage structure has been constructed at cost of Rs.13.00 Crores. The flow in the river Sankaraparani can be impounded for a height of 1.50m which has water spread area of 1.80 sq.Km with its average bed width of 360mts.

Due to storage of water, the water table in the surrounding inland borewells have apparently raised.

CONSTRUCTION OF CHECK DAM ACROSS SOUTH PAMBAIYAR RIVER AT SANYASIKUPPAM IN MANNADIPET COMMUNE.

- A bed dam has been constructed during the year 2003 at a cost of Rs.59.29 lakhs. By construction of the bed dam, water has been stored in the upstream side for the purpose of increasing the ground water potential,

CONSTRUCTION OF DIVERSION ANICUT ACROSS RIVER PENNAIYAR (SITHERI)



The anicut has been constructed during the year 2005 at a cost of Rs. 602 lakhs The purpose of constructing anicut at this location is to divert water through Sitheri authu voikal and fill up the Bahour Sitheri, Kirumampakkam eri, Sadakulam, Aratchikuppam, Manapet, Utchimedu, Melparickelpet, Keezhparickalpet tanks.

On the upstream side of the bed dam, considerable quantum of flood water is stored for the purpose of groundwater recharge. Ayacut benefitted by the construction of anicut is 461 Ha.

CONSTRUCTION OF BED DAM IN CHUNNAMBAR ON THE BED OF OLD BRIDGE TO PREVENT ENTRY OF SALT WATER IN NONANKUPPAM VILLAGE.

- The check dam has been constructed during the year 2005 at a cost of Rs. 402 lakhs at the infall point of the Bay of Bengal. The purpose of this construction is mainly to arrest the extention of backwater. Also due to this construction, water is stored in the upstream side for groundwater recharge and water quality improvement.

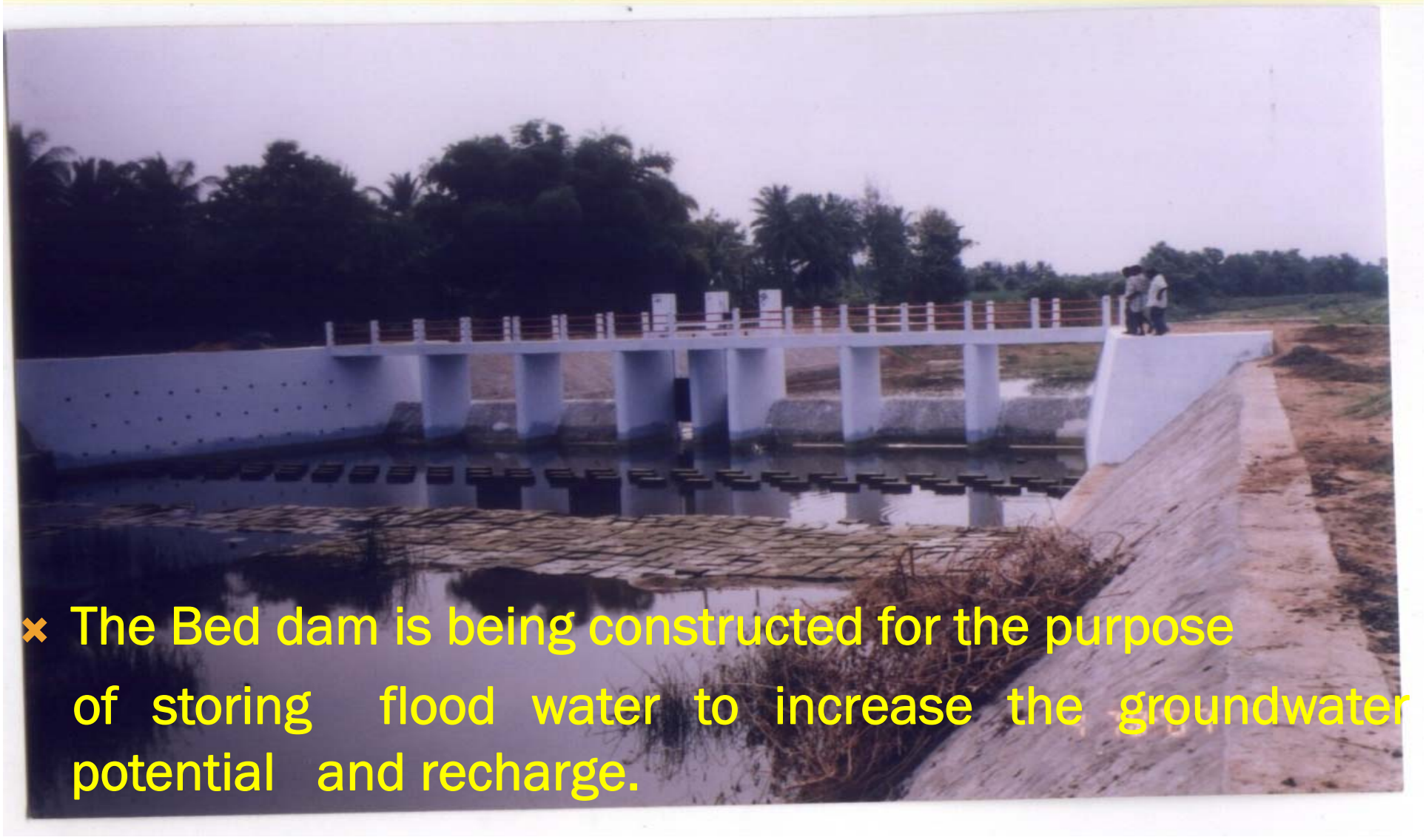
CONSTRUCTION OF BED DAM WITH FOOT BRIDGE ACROSS THE RIVER GUDUVAIYAR AT KORKADU.

- A check dam has been constructed across river Guduvaiyar at Korkadu village to a length of 25.00m and to a height of 1.50m. The cost of the project is Rs. 47.80 lakhs. The impounding water during rain/flood season can be utilized for recharge purposes and irrigation purpose during drought season.

CONSTRUCTION OF BED DAM ACROSS THE GUDUVAIYAR RIVER BRIDGE IN PUDUCHERRY.

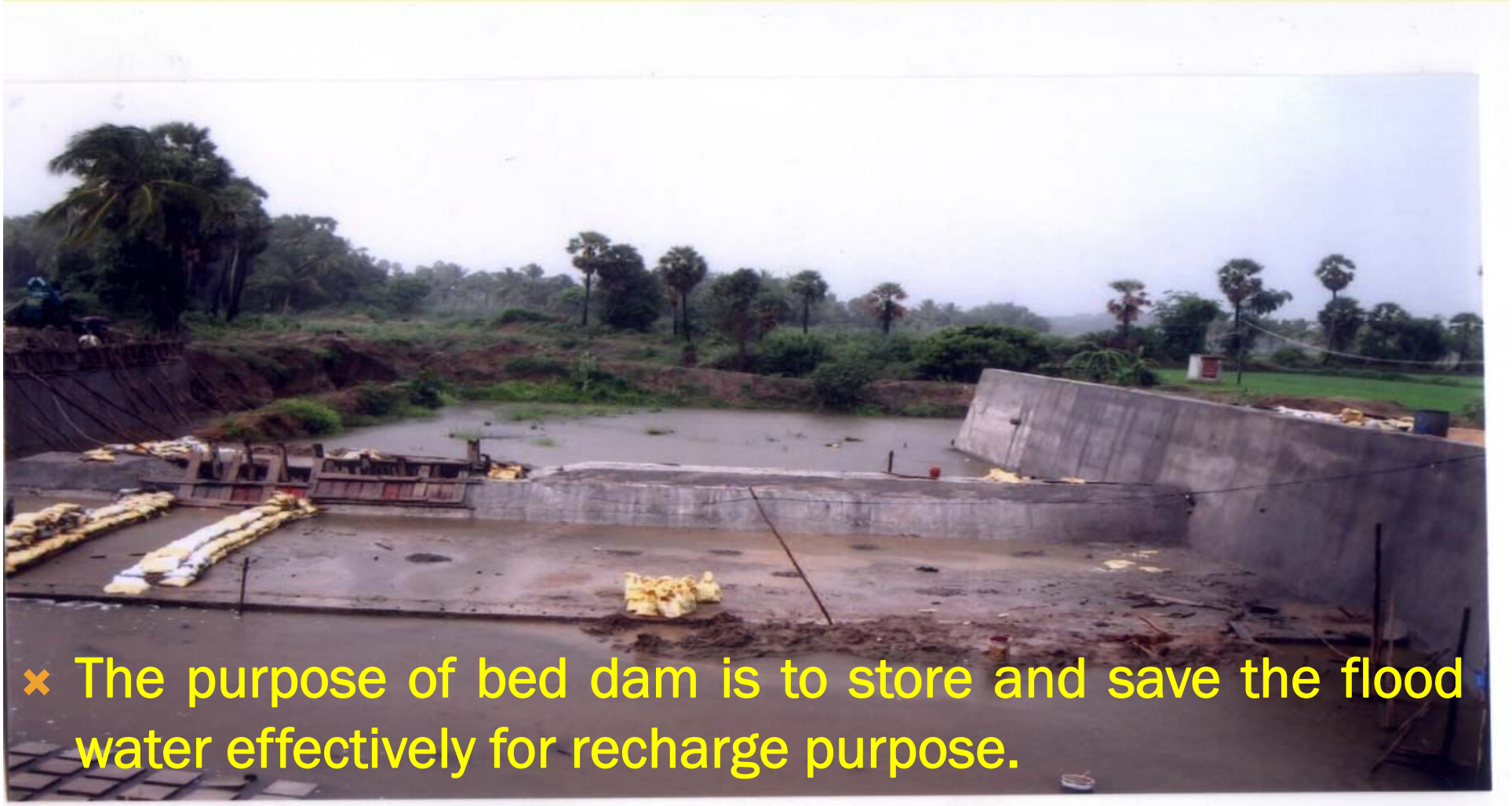
- The bed dam has been constructed during the year 2006 for an amount of Rs 1300 lakhs to impound flood water for recharging purpose.

CONSTRUCTION OF BED DAM WITH FOOT BRIDGE ACROSS THE RIVER MALATAR AT NETTAPAKKAM IN PONDICHERRY.



- The Bed dam is being constructed for the purpose of storing flood water to increase the groundwater potential and recharge.

CONSTRUCTION OF BED DAM ACROSS GUDUVAIYAR UPSTREAM SIDE OF KEEZHAGRAHARAM ROAD BRIDGE IN PUDUCHERRY (UNDER CONSTRUCTION).



- The purpose of bed dam is to store and save the flood water effectively for recharge purpose.

CONSTRUCTION OF BED DAM CUM FOOT BRIDGE ACROSS RIVER MALATAR AT VADUKUPPAM, PUDUCHERRY.

- The purpose of bed dam is to impound the flood water effectively for recharge purpose.

CONSTRUCTION OF SUTHUKENI ANICUT IN SANKARAPARANI RIVER.

- This anicut was constructed during ex-French Regime period i.e., in the year 1874 across the river Sankaraparani. The water from the river is diverted to the Suthukeny channel and fed to the Oussudu tank. The tank water is utilized by an ayacut of 600Ha of agricultural land.

CONSTRUCTION OF PILLAIYARKUPPAM ANICUT IN SANKARAPARANI RIVER

- This anicut was constructed during the French Regime across the river Sankaraparani. This anicut is used to divert water for irrigation purpose through Authuvoikkal to Murungapakkam and Olandai tanks for the purpose of irrigating an ayacut of 170Ha.

CONSTRUCTION OF MANGALAM ANICUT IN GUDUVAIYAR RIVER

- This anicut was constructed during French period. Water is diverted by the anicut through Uruvaiyar feeding channel, feeding Uruvaiyar, Keezhagaraharam, Thirukanji tanks. Ayacut benefited by this anicut is 112 Ha.

IMPACT OF THE CHECK DAMS ON THE GROUNDWATER LEVELS

Sl.No.	*Check Dams*	*Location of Observation Tube Wells*	*Average Rain Fall-1241 mm*			*Rain Fall-1588 mm*		
			Monsoon Water Level in mt(06-07)			*Monsoon Water Level in mt (10-11)*		
			June'06	**Jan' 07**	**Change in WL.**	**June'10**	**Jan' 11**	**Change in WL.**
1	Suthukeni Dam	Thethampakkam	9.71	9.85	**-0.14**	10	9	**1.00**
2	Pillayarkkuppam	Pillayarkkuppam	21.62	17.94	**3.68**	15.45	6.6	**8.85**
3	Chunnambar	Ariyankuppam	5.12	4.49	**0.63**	14.65	11.33	**3.32**
4	Uruvaiyur	Aariyapalayam	20.46	16.73	**3.73**	19.7	13.55	**6.15**
5	Manalipet	Thirukkanur, Koonichampattu (TRPP)	30.16	28.62	**1.54**	30.15	19.7	**10.45**
6	Kuduvaiyar	Mangalm	22.64	18.96	**3.68**	21	16.5	**4.50**
7	Silkaripalayam	Silkaripalayam (TRPP)	18.84	14.46	**4.21**	19	14.2	**4.80**
8	Sanyasikuppam	Sanyasikuppam (TRPP)	10.63	5.8	**5.8**	10.85	6.5	**4.35**
9	Nattapakkam	Kariamanickam	29.54	21.58	**7.96**	25.8	24.1	**1.70**
10	Sornavour	Karyambathur	26.51	24.39	**2.12**	27.9	17.75	**10.15**
11	Bahour Chitteni	Kurivinatham	7.79	5.43	**2.36**	7.5	3.2	**4.30**
12	Thirukanchi	Thirukanchi	13.01	13.04	**-0.03**	13.15	8.35	**4.80**
13	Korkadu	Korkadu	25.91	21.7	**4.21**	22.8	17.6	**5.20**

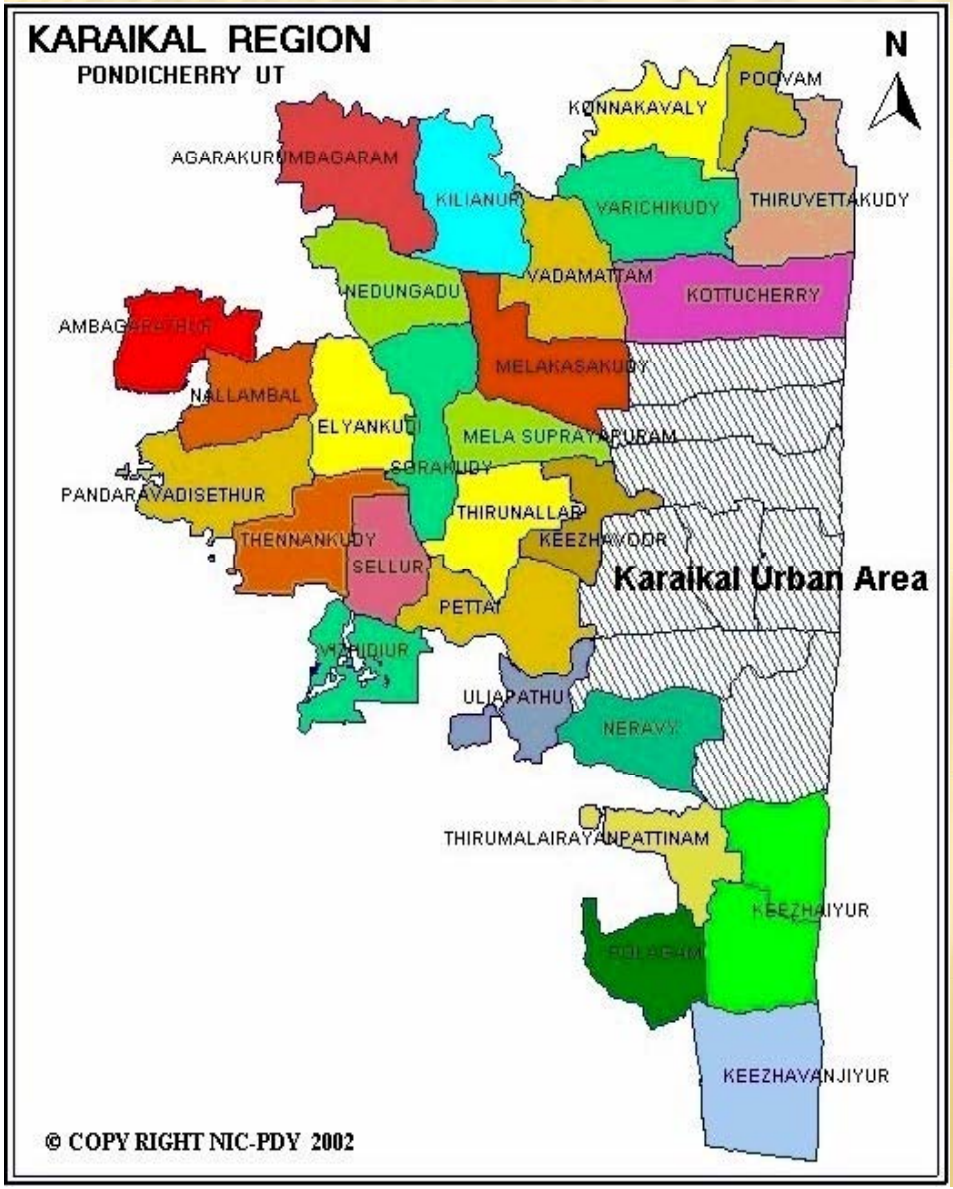
IMPACT OF THE RECHARGE MEASURES ON THE GROUNDWATER

- A) As per groundwater potential assessment report as on March, 2004, the percentage of development of groundwater in Pondicherry region touched 179%.
- B) As per reassessment of groundwater potential as on March, 2009, the percentage of development of groundwater in Pondicherry region lowered to 150%.

REMEDIAL MEASURES TO INCREASE GROUNDWATER POTENTIAL & QUALITY.

- 84 No's of tanks were rehabilitated to increase their water holding capacity from 45 to 75 MCM with European Union assistance.
- 25 Nos of Check dams were constructed across the river courses to impound the flow during the monsoon period .
- Roof top Rainwater harvesting structures were provided in almost all Govt. Buildings.
- Considerable no. of village ponds were rehabilitated to increase their water holding capacity and Recharge Tube wells constructed in the desilted ponds .
- 100 % subsidy assistance is being extended to renovate the defunct dug wells and dug cum bore wells in the farmers lands for harvesting rainwater.
- Attractive Subsidy assistance is being extended to private institutions and industries for providing Rainwater harvesting structures.
- Attractive Subsidy assistance is being extended to farming community for undertaking water conservation measures like laying of underground pipe lines , installation of Drip / Sprinkler irrigation systems.
- A Novel Scheme " Precision farming " was introduced by the Department of Agriculture from the Current financial year onwards for conservation of water.
- Farmers are educated to cultivate low water consuming crops , adopt drip irrigation for sugarcane crops & adhere to SRI technology in paddy cultivation for minimizing the crop water requirements.

GEOGRAPHIC LOCATION OF KARAIKAL



E.Longitude : 79’ 37”.00 to 79 53” 00

N.Latitude : 10 49” 00 to 11 01” 00

Total area of Karaikal is 160 Sq. Kms

STATUS OF WATER RESOURCES IN KARAIKAL REGION

I .SURFACE WATER:

a) Karaikal region lies in the tail end of River Cauvery

b)Karaikal region is traversed by seven no's of tributaries of Cauvery.

c)Flows in the Rivers are controlled by the operation of Grand Anicut on the Cauvery River which lies in Tamil Nadu.

d) Owing to the dispute on the sharing of Cauvery water, there is insufficient flow in the Rivers of Karaikal.

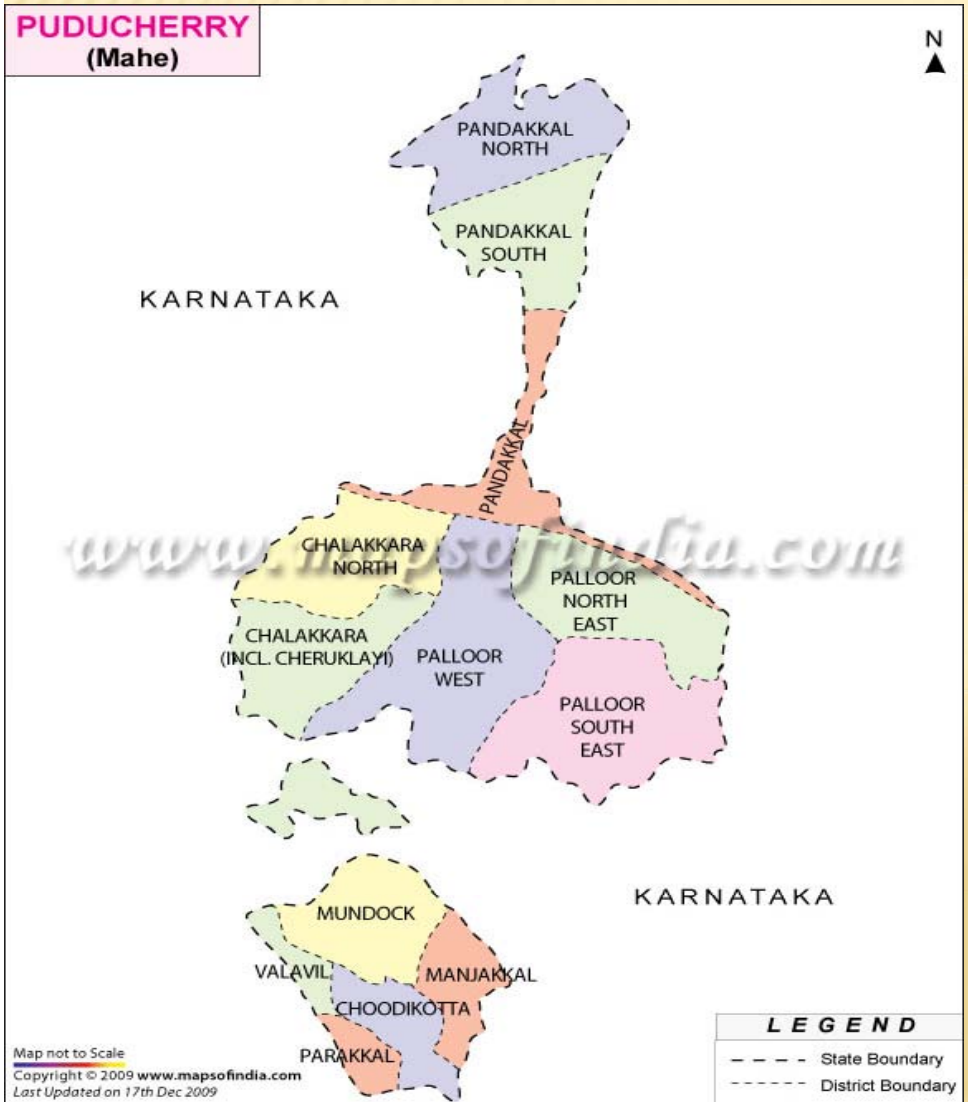
STATUS OF WATER RESOURCES IN KARAIKAL REGION –CONT.

II.GROUNDWATER:

a)The Aquifer systems are sedimentary type and constitute

1. Alluvial aquifer, Karaikal beds and Cuddalore sandstones, of which the Alluvial and Cuddalore sandstone are feasible for Groundwater mining and that too is restricted in certain pockets due to saline problems.
2. Owing to hydro salinity conjunctive use of groundwater with surface water is the alternative solution to utilise the available Groundwater Resources.
3. Govt of Puducherry has constructed 85 Nos of Community Tube wells to subliment the surface water irrigation, With a view to impound the surface water , Dept of Agriculture is extending attractive subsidy assistance to farmers for constructing farm ponds.

DETAILS OF MAHE REGION

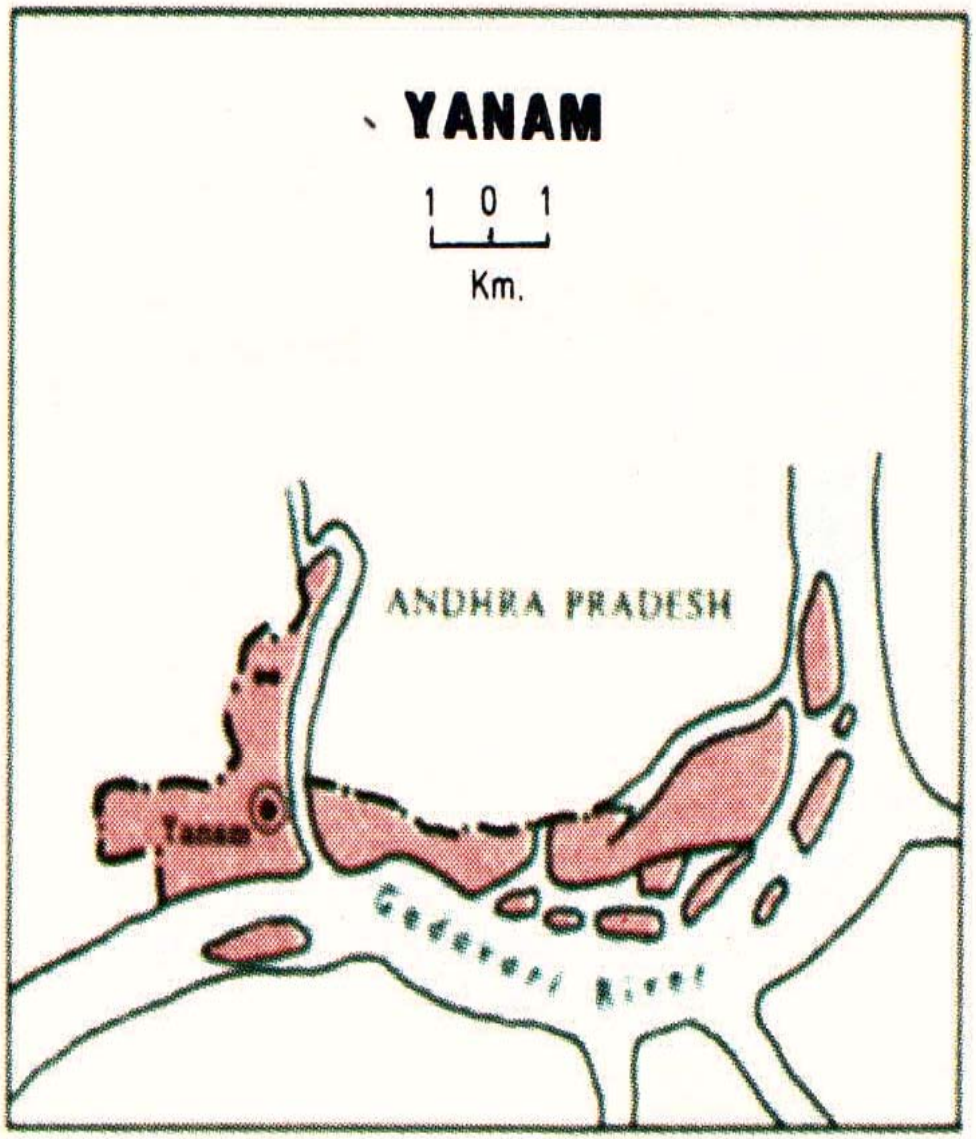


Total area of Mahe is 9. Sq. Kms, and is lying on the West Malabar coast

STATUS OF WATER RESOURCES IN MAHE REGION.

- There is very little scope to develop groundwater as thick lateritic cap overlies the massive granite, which is a poor aquifer.
- The annual average Rain fall is 3300 mm and could not be used for future growth, since the area is a hilly terrain
- Though most of the houses has open dug well to meet the daily water requirement, they become dry in summer months between March to June.

DETAILS OF YANAM REGION.



Total area of Yanam is 30 Sq. Kms and is lying on the East Coramandal coast.

STATUS OF WATER RESOURCES IN YANAM REGION.

- Yanam region is located at the tail end of Godavari River and the surplus flows of the Godavari River will be used for future growth.

- The Groundwater in Yanam region is totally saline in both shallow and deep aquifers.

STAGES OF DEVELOPMENT OF GROUNDWATER IN THE U.T.OF PUDUCHERRY.

Sl.No	Name of the Region	% of development as on March -2004	March -2008	Category
1.	Puducherry	179	153	Over exploited
2.	Karaikal	19	15	Safe
3.	Mahe	56	66	Safe
4.	Yanam	Groundwater is saline		

REGULATORY MEASURES TO CONTROL EXPLOITATION OF GROUNDWATER IN THE U.T .OF PUDUCHERRY.

- To control and regulate the exploitation of groundwater in the U.T of Pondicherry , a Ground Water Act, titled, “The Pondicherry Ground Water (Control and Regulation)Act,2002” was enacted in 2004, and a separate body to enforce the act, in the name of Pondicherry Ground Water Authority, was established .
- Construction of rainwater harvesting and installation of STP/ETPs in all buildings has been made mandatory , enforced through the Department of Town and Country Planning.

RAINWATER HARVESTING TECHNIQUES ADOPTED

- Desilting/Renovation of Percolation Ponds and construction of recharge tube wells in the renovated ponds.
- Renovation of defunct dug wells and dug cum borewells for recharging
- Construction of roof top rainwater harvesting structures in Government Buildings and in private industrial and institutional buildings
- Construction of recharge shafts in the river beds.

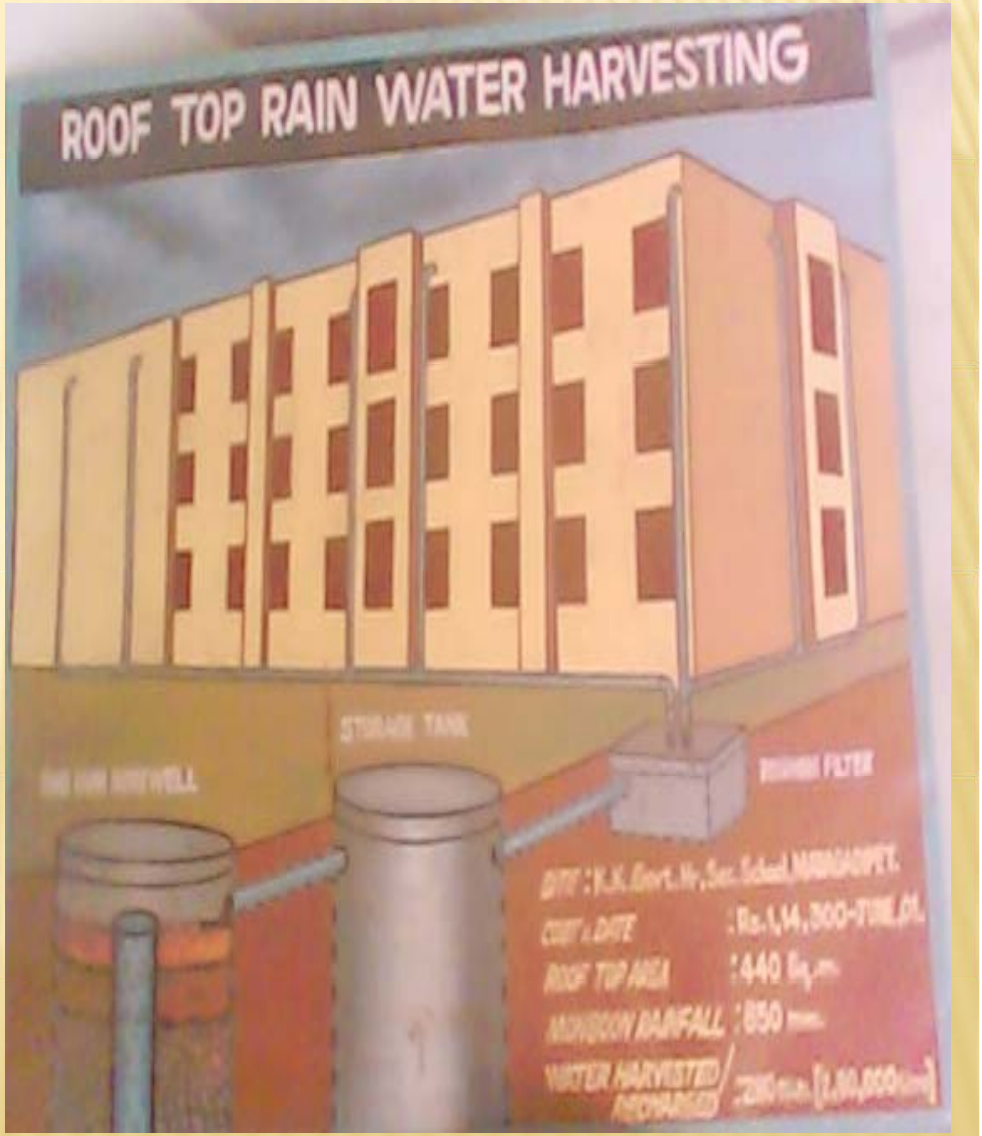
PROPOSED MEASURES TO MAXIMIZE RECHARGE.

- The presence of impervious layer at shallow depths in most of the river courses arrests recharge from river beds. It is therefore proposed to construct recharge shafts in the water holding area of the Check Dams to increase the rate of recharge of the shallow as well as the Deeper aquifers.
- The occurrence of Limestone as out crop in the North Western part of Puducherry is affecting the groundwater recharge rate drastically, for which a purpose driven study under Hydrology Project-II, is being under taken to improve recharge in that area.
- The renovation of Dug wells and dug-cum-bore wells ,which were previously utilized by farmers for mining of groundwater is ample source for recharge of groundwater aquifers and has to be geared up intensively .

ROOF TOP RAINWATER HARVESTING IN GOVT. BUILDINGS.

AGRL.COMPLEX, THATTANCHAVADY

SCHOOL BUILDING IN MADAGADIPET



VARIOUS RAINWATER HARVESTING STRUCTURES

RWH - IN SEED PROCESSESING UNIT – MADHAGADIPET.

Rain water Harvesting through Dug well.

Thank you....

Tank u for your attention !