Vellar Basin

Introduction

The Vellar river basin is one of the seventeen river basins of Tamil Nadu. The Vellar River has its origin from three rivers. (i)Anaimaduvu river originates from Velanguttu hills at an altitude of 1122m and flows from west to southeast direction in Salem district (ii) Thumbal river originates from Thumbal hills at an altitude of 772m. It gains its name as Kallar river at Idayapatti [Long 78˚29’29”E, Lat 11˚45’6”N] and confluences with Anaimaduvu river at Ramanatham village [Long 78˚25’49”E, Lat 11˚41’35”N] in Salem district (iii) Singipuram river originates from Tengal hills, Jambuttu hills and Perumal hills of Attur taluk of Salem district, and joins the confluenced river of Kallar and Anaimaduvu at Vaittikavundan pudur[Long 78˚26’47”E, Lat 11˚39’31”N] and travels as Vasista Nadhi upto Kalpaganur[Long 78˚32’26”E, Lat 11˚37’57”N] and thereafter the river is called as Vellar river. Ellar river originating from Velliyur village [Long 78˚46’36”E, Lat 11˚28’45”N] at an elevation of 160m joins Vellar river near Mettur village [Long 78˚54’25”E, Lat 11˚27’45”N]. The major tributaries, viz., Swethanadhi, Chinnar river, Anaivari odai, Gomukhi river, Manimuktha river and Periyaodai are joining with Vellar river and the river flows through Dharmapuri, Salem, Namakkal, Trichy, Perambalur, Ariyalur, Villupuram, Cuddalore districts and finally confluences with the Bay of Bengal. The Vellar river basin falls in 22 Survey of India Toposheets (1:50,000 scale) 58/I/2,3,5,6,7,9,10, 11,12,13,14,15,16 and 58/M/1,2,3,4,6,7,10,11,15.

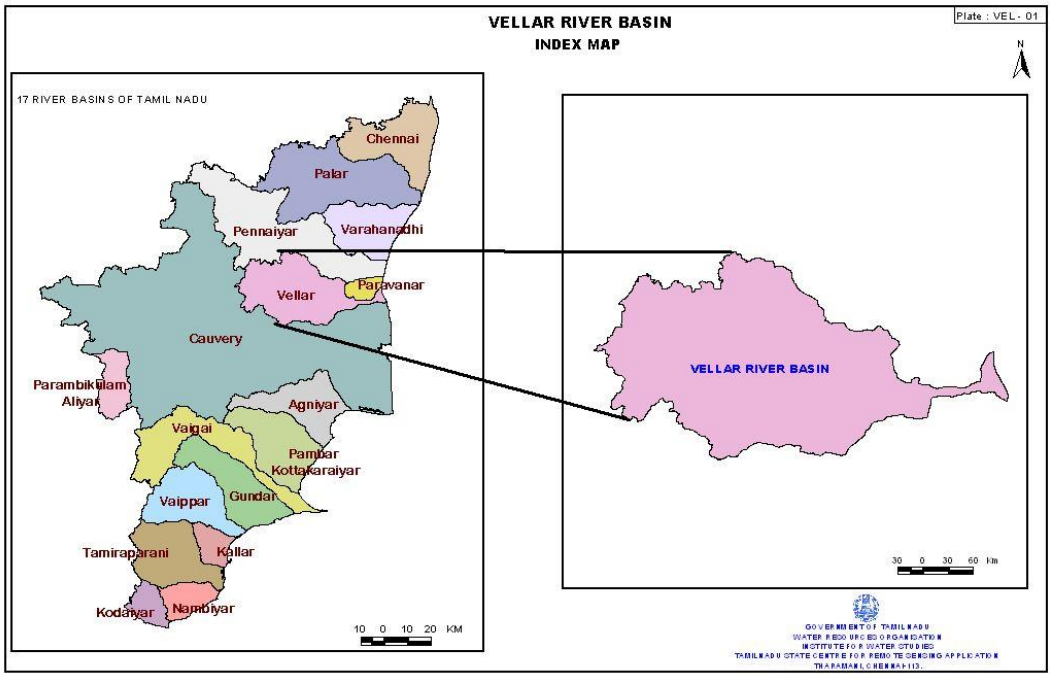

Figure 1 Index Map of Vellar River Basin

The Vellar river Basin consists of 7 Sub basins, namely, Upper Vellar, Swethanadhi, Chinnar, Anaivari odai, Gomukhinadhi, Manimukthanadhi and Lower Vellar. The areaof Administrative Districts, Taluks and Blocks falling in Vellar river basin is given in **Table 1.**

The Basin has a total geographical area of 7504.346 Sq.Km covering 22 taluks, 40 blocks falling in parts of 8 districts, namely, Dharmapuri, Salem, Namakkal, Trichy, Perambalur, Ariyalur, Villupuram, and Cuddalore districts of TamilNadu.

Table 1 Administrative Districts, Taluks & Blocks

	DISTRICT NAME	DISTRICT AREA FALLING IN THE BASIN Sq.Km	No.	TALUK NAME	TALUK AREA FALLING IN THE BASIN Sq.Km	No.	BLOCK NAME	BLOCK AREA FALLING IN THE BASIN Sq.Km
1	Dharmapuri	39.163	1	Pappiredipetti	39.163	1	Pappireddipatti	39.163
2	Salem	1965.85	2	Salem	78.946	2	Panaimarathupatti	17.052
						3	Ayothyapattinam	61.894
			3	Vazhapadi	224.047	4	Vazhapadi	224.047
			4	Athur	858.593	5	Peddanaickanpalayam	533.288
						6	Athur	325.305
			5	Gangavalli	804.264	7	Gangaivalli	397.357
						8	Thalaivasal	406.907
3	Namakkal	378.535	6	Rasipuram	371.642	9	Vennandur	11.856
			7	Namakkal	6.893	10	Namagiripettai	226.47
						11	Kollimalai	133.316
						12	Sendamangalam	6.893
4	Trichy	172.87	8	Thuraiyur	172.87	13	Uppliyapuram	25.351
						14	Thuraiyur	147.519
5	Perambalur	1208.798	9	Veppanthattai	552.315	15	Veppanthattai	552.315
			10	Perambalur	258.692	16	Perambalur	258.692
			11	Kunnam	397.791	17	Alathur	34.888
						18	Veppur	362.903
6	Ariyalur	492.190	12	Ariyalur	54.012	19	Ariyalur	54.012
			13	Sendurai	264.222	20	Sendurai	264.222

			14	Udaiyarpalayam	173.956	21	Andimadam	150.323
						22	Jayankondam	23.633
7	Villupuram	1593.274	15	Sankarapuram	530.101	23	Kalrayan Hills	411.768
						24	Sankarapuram	68.704
						25	Rishivandiyam	49.629
			16	Kallakurichi	994.735	26	Kallakurichi	337.235
						27	ChinnaSalem	415.88
						28	Thiyagadurgam	241.62
			17	Ulundurpettai	68.438	29	Ulundurpettai	56.103
						30	Thirunavalur	12.335
8	Cuddalore	1653.666	18	Thittakudi	461.177	31	Mangalur	461.177
			19	Virudhachalam	784.243	32	Nallur	358.122
						33	Virudhachalam	304.584
						34	Kammapuram	121.537
			20	Kattumannarkoil	152.941	35	Kattumannarkoil	96.07
						36	Kumaratchi	56.871
			21	Chidambaram	228.419	37	Melbhuvaangiri	75.506
						38	Keerapalayam	19.085
						39	Parangipettai	133.828
			22	Cuddalore	26.886	40	Kurinjipadi	26.886
	Total	**7504.346**			**7504.346**			**7504.346**

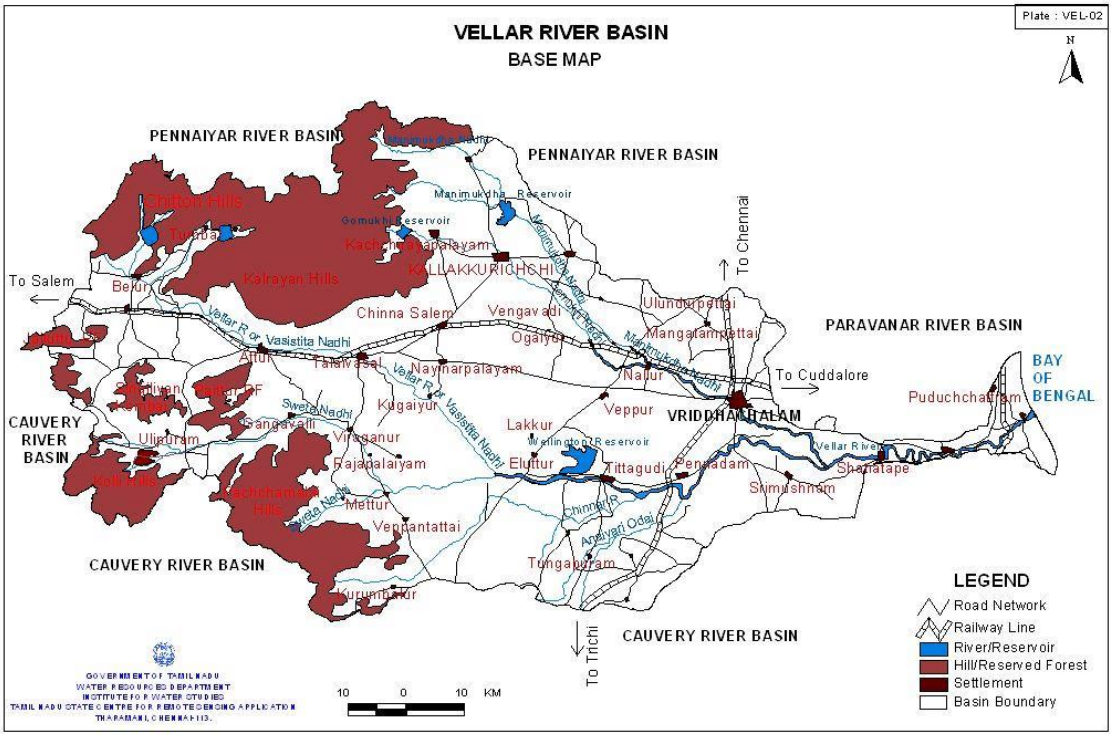

Figure 2 Base map of Vellar River Basin

This Figure depicts the rivers and reservoirs in the basin, hills and reserved forest and settlements.

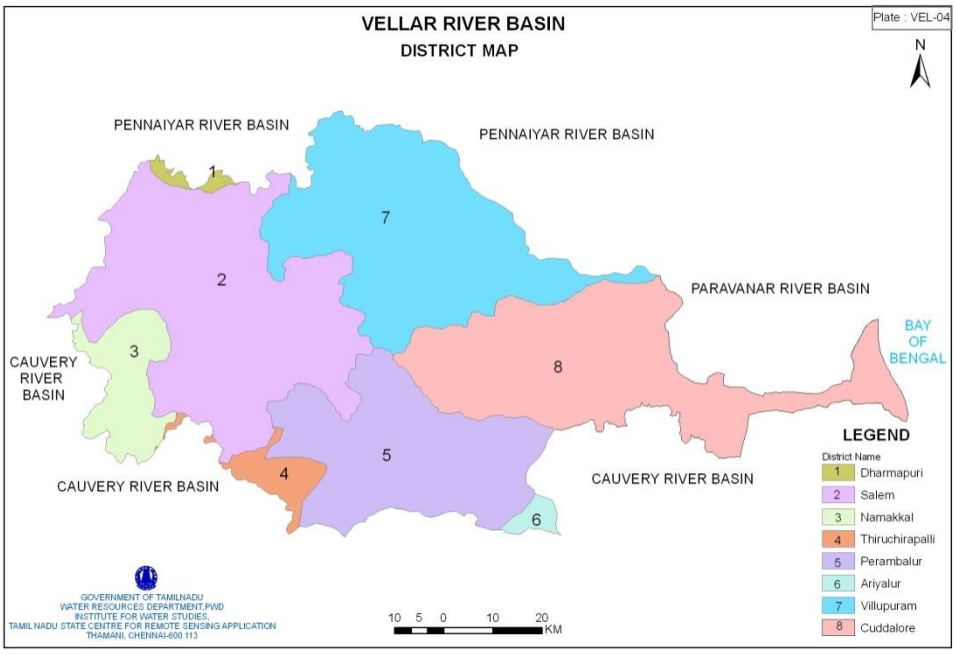

Figure 3 District Map of Vellar River Basin

The number of districts covered by the basin is illustrated.

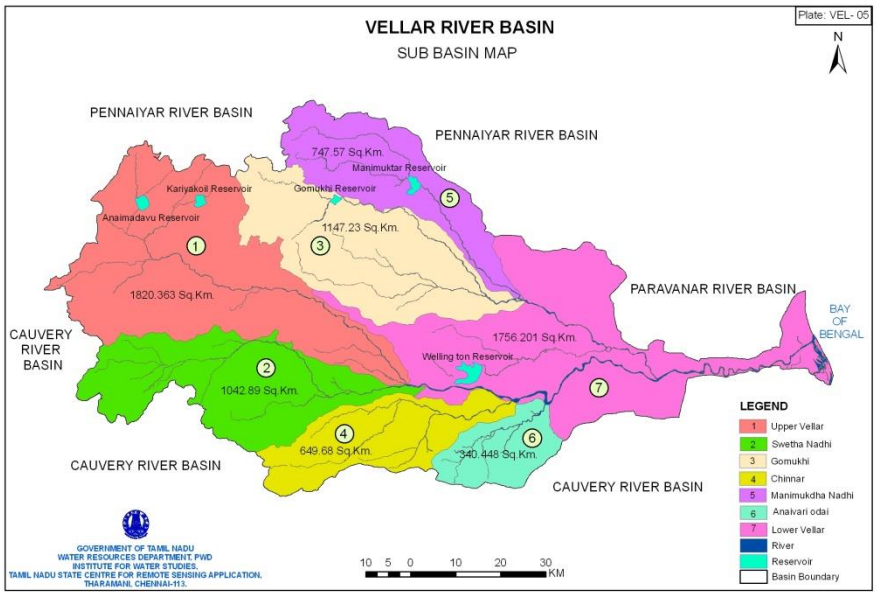

Figure 4 Sub basin Map of Vellar River Basin

The sub-basins in the Vellar river basin are shown in this figure. The area of the sub-basins covering the basin is also given in this figure. There are 7 sub-basins: Upper Vellar, Swetha nadhi, Gomukhi, Chinnar, Manimuktha nadhi, Anaivari Odai, Lower Vellar. The biggest sub-basin is Upper Vellar with 1820.363 Sq.Km. and the smallest sub-basin is Anaivari Odai with 340.446 Sq.km.

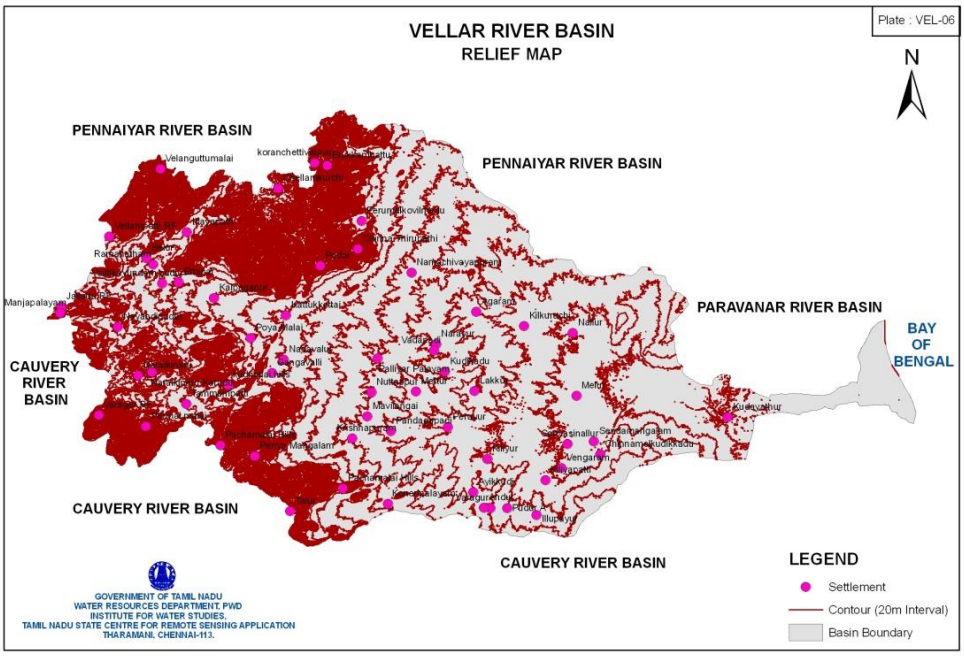

Figure 5 Relief Map of Vellar River Basin

The main tributaries of Vellar river are Vasistanadhi, Swethanadhi, Manimukthanadhi and Gomuki, Chinnar and Anaivari odai. Both Vasistanadhi and Swethanadhi originate in Salem district and drain from Chitteri Pachaimalai, Kollimalai and Kalrayan hill areas. The Relief features are shown in Figure 5. The maximum of elevation is +1266m (a peak) near Batu malai at longitude 78° 28’ and latitude 11° 52’ in the southern slope of Kalrayan hills, where Vasista Nadhi originates. The last tributary to join Vellar is Manimuktha nadhi. This tributary very often meander in its course with about +20m to +40m elevation at B at Udaiyur and Bhuvanagiri area in Chidambaram taluk and finally it empties into Bay of Bengal in Parangipettai in Chidambaram taluk.

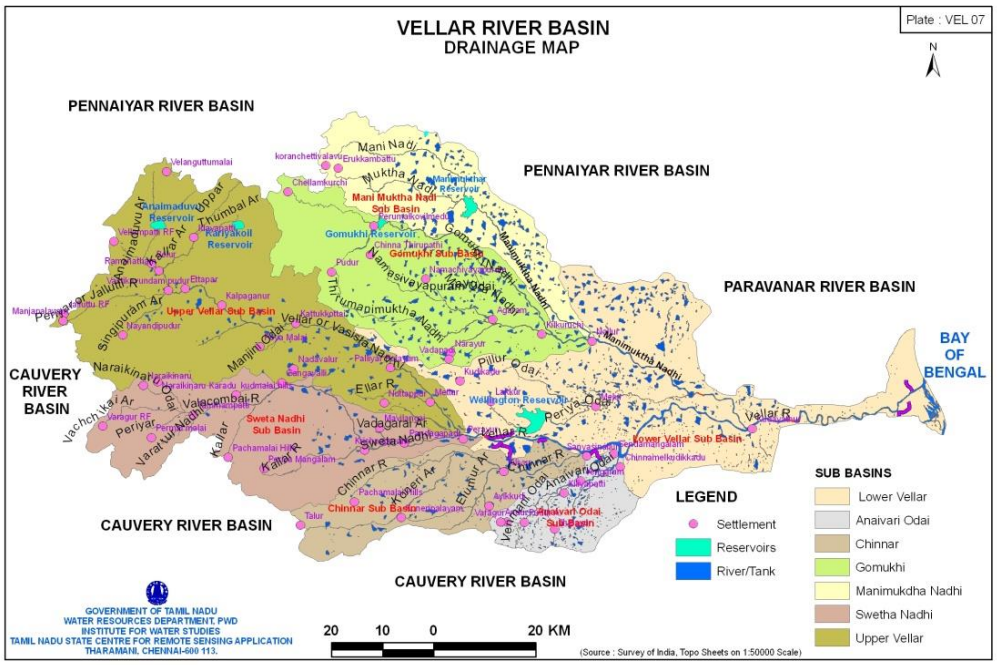

Figure 6 Drainage Map of Vellar River Basin

The terrain between the Kalrayan hills and the Kollimalai – Pachamalai range in the Attur taluk of Salem district is drained by two rivers, one Vasistanadhi also known as Vellar and the other Swethanadhi. These two rivers are separated by the Paittur hills and they join to form the Vellar in the Perambalaur taluk of Perambalaur district. The drainage details are given in Figure 6.

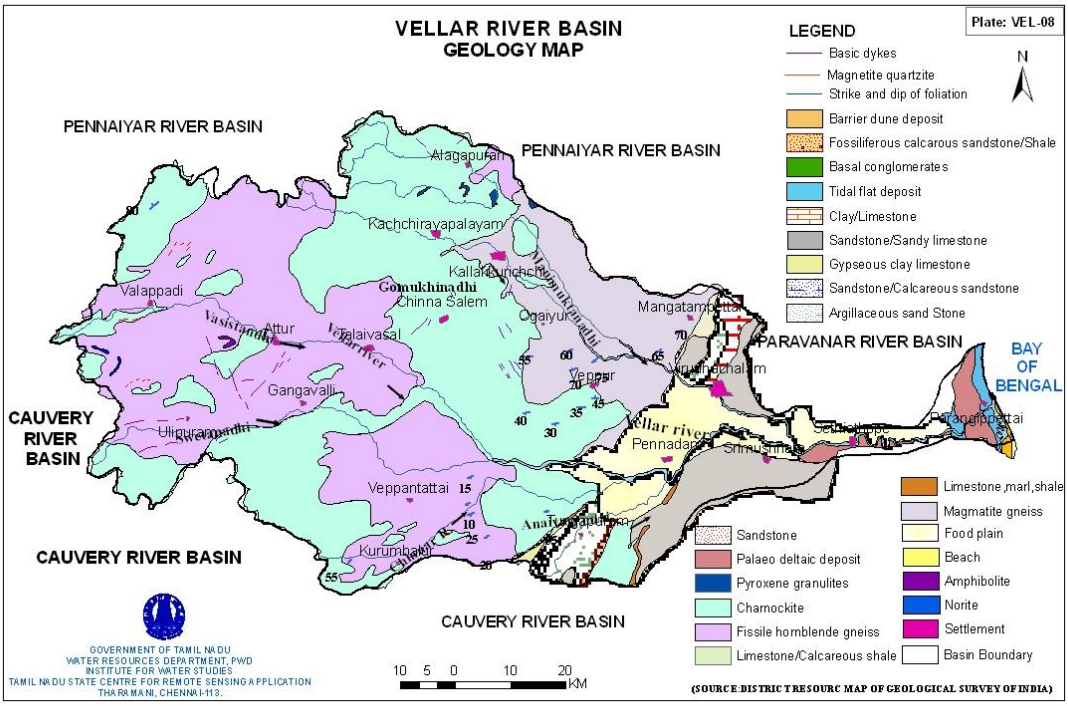

Figure 7 Geology Map of Vellar River Basin

In this basin, Archaean group of rocks occur on the western part of the basin and sedimentary formations of Cretaceous, Tertiary and Quarternary systems on the eastern part. Archaean group of rocks include amphibolite, norite, pyroxene granulite, magnetite quartzite, mixed gneisses, charnockites and granite gneisses as older members which are intruded by younger granites, dolerites, pegmatites and quartz veins. Charnockites and gneisses occupy the major part of the area.Sedimentary formation of Cretaceous, Tertiary and Quartenary ages occupy about 18% of the total area confining to the eastern part, unconformably overly the Archaeans.

Cuddalore sandstones of Tertiary formation occur north of Vellar river near Virudhachalam and are made up of sandstones, clays, sand and silt. The lower Cuddalore sandstone is unconsolidated and has a thickness of about 220m. The Upper Cuddalore formation consists of clay bound and consolidated in places to sandstone and intercalated with clay lenses and covered on top by lateritic formations. The thickness is variable from 30m to 250m towards East. The lignite occurs as thin seems between 60m to 80m below ground level. Soils are varying from red soil to thin red, fawn loamy and black clayey in the area while the alluvial soil is found along the rivers and coastal areas.

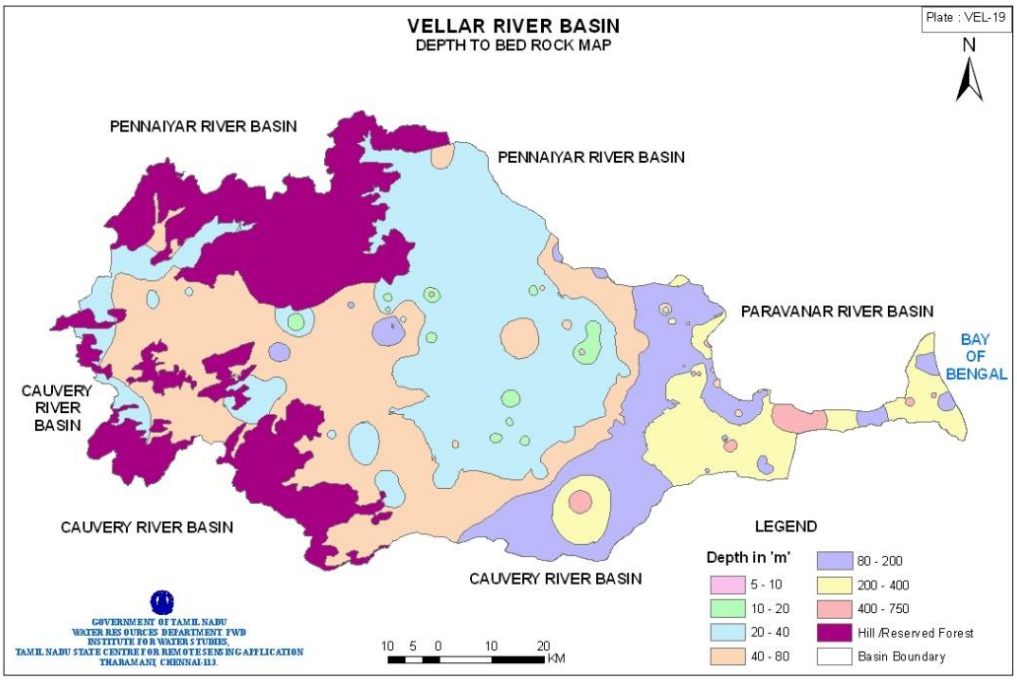

Figure 8 Depth to Bedrock Map of Vellar River Basin

The depth to bedrock map of this basin shows the depth at which there exists fresh rock and also implies that the chance of getting sufficient groundwater below this depth is very rare. The aquifer above this bedrock in hard rock areas is made up of weathered rock or fractured rock or both (as layers). The categorization of fractured rock includes jointed rocks also. Similarly the aquifer above the bedrock in sedimentary area is made up of sandstone/limestone or alluvium. The alluvium consists of sand/clayey sand/sandy clay/clay as layers.

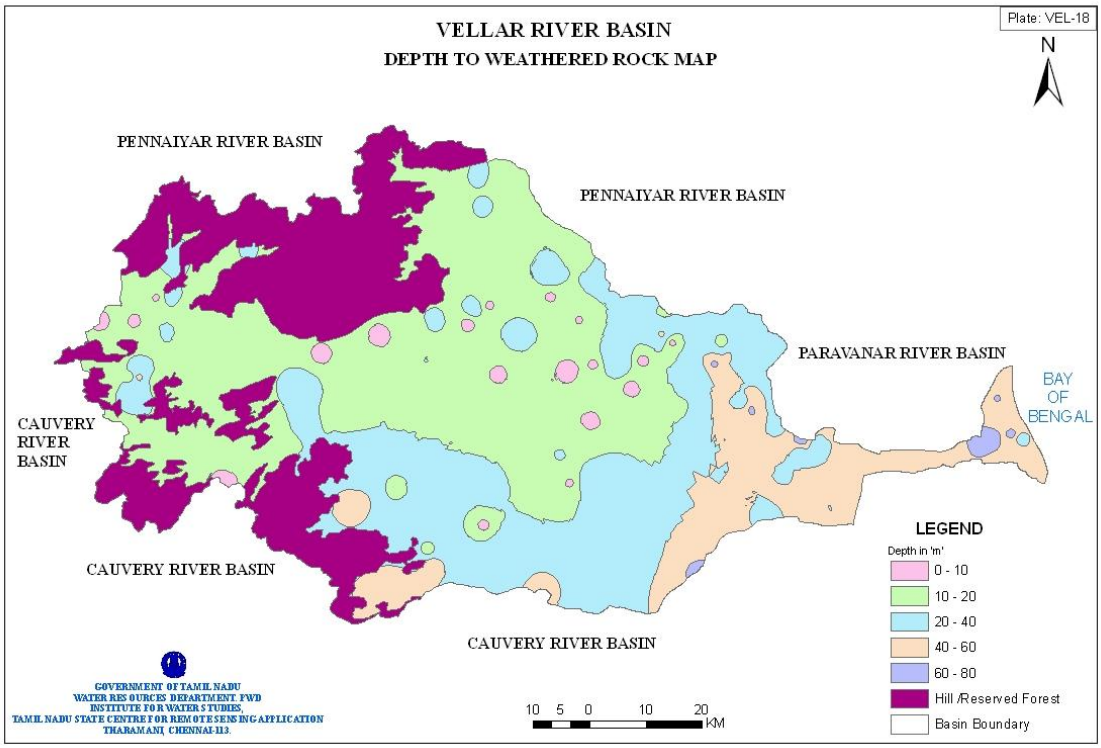

Figure 9 Depth to Weathered Rock Map of Vellar River Basin

Normally, the weathered rock aquifer of this basin exists upto a depth of 10 to 30 m below ground level. Similarly, the fractured rock aquifer occurs upto a depth of 40 to 60 m below ground level in general. In sedimentary region generally the aquifer extends upto a depth of 100 to 300 m below ground level. Along the coastal region the depth to bedrock extends beyond 300 m. In the western parts of the basin along the foothill regions the depth to bedrock ranges between 30 and 70 m. The weathering/fracturing or both seems to be more in the gneissic region than in charnockitic region. The possibility of more fracturing in gneissic region is also suggested by the dominance of structural features present in the gneissic rocks such as fault zone, shear zones, folds, lineaments and dykes.

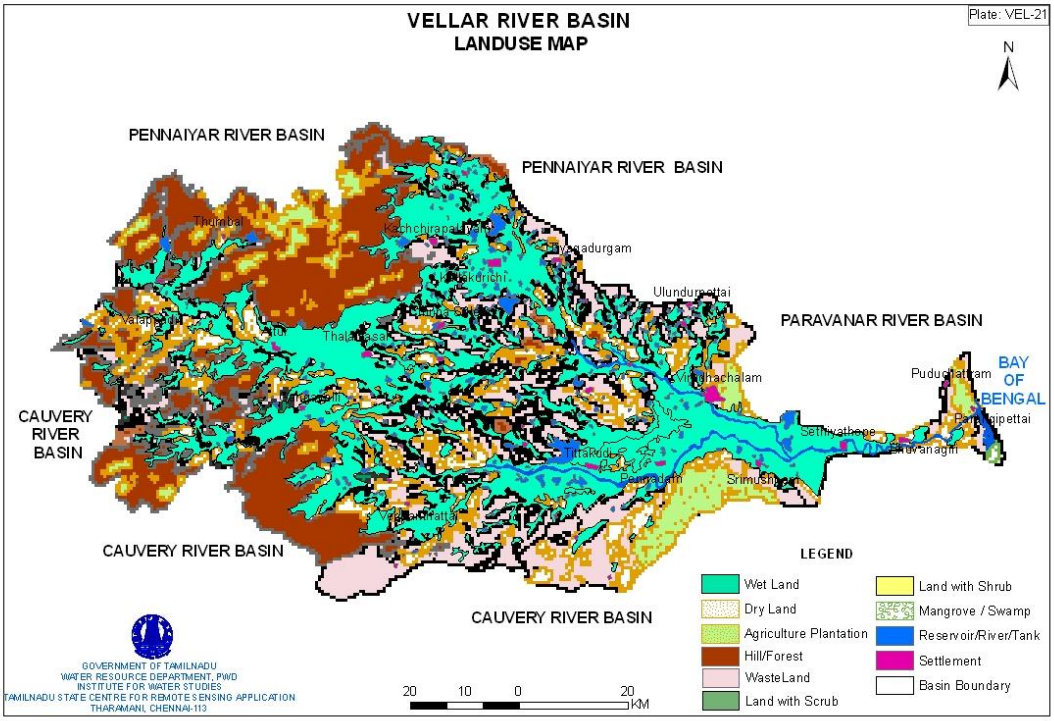

Figure 10 Landuse Map of Vellar River Basin

The land use map is shown in the above figure. The classification of land use map with their area and percentage of the total arae is given in the table below.

Table 2 Classification of Land use category

Sl. No.	Land use category		Area in Sq.Km.	Percentage %
	Level I	Level II		
1	Built up Land	Towns, Villages, Roads	41.566	0.55
2	Agricultural land	Wet Crop : Paddy, Sugarcane	2091.628	27.87
		Dry Crop Groundnut, pulses Cholam, Floriculture, Tapioca	763.372	10.17
		Agricultural plantations	397.255	5.29

3	Forest Land	Dense Forest, Scrub Forest, reserved forest and forest plantation	1662.06	22.15
4	Water bodies	Reservoirs, rivers, streams, tanks and ponds.	260.723	3.48
5	Waste Land	Land with scrub Land with shrub Mangrove Barren land Barren out crop Saline/Sodic Gulley land Swamp Beach barren Beach terrace Beach terrace with trees	2287.742	30.49
	Total		**7504.346**	**100**

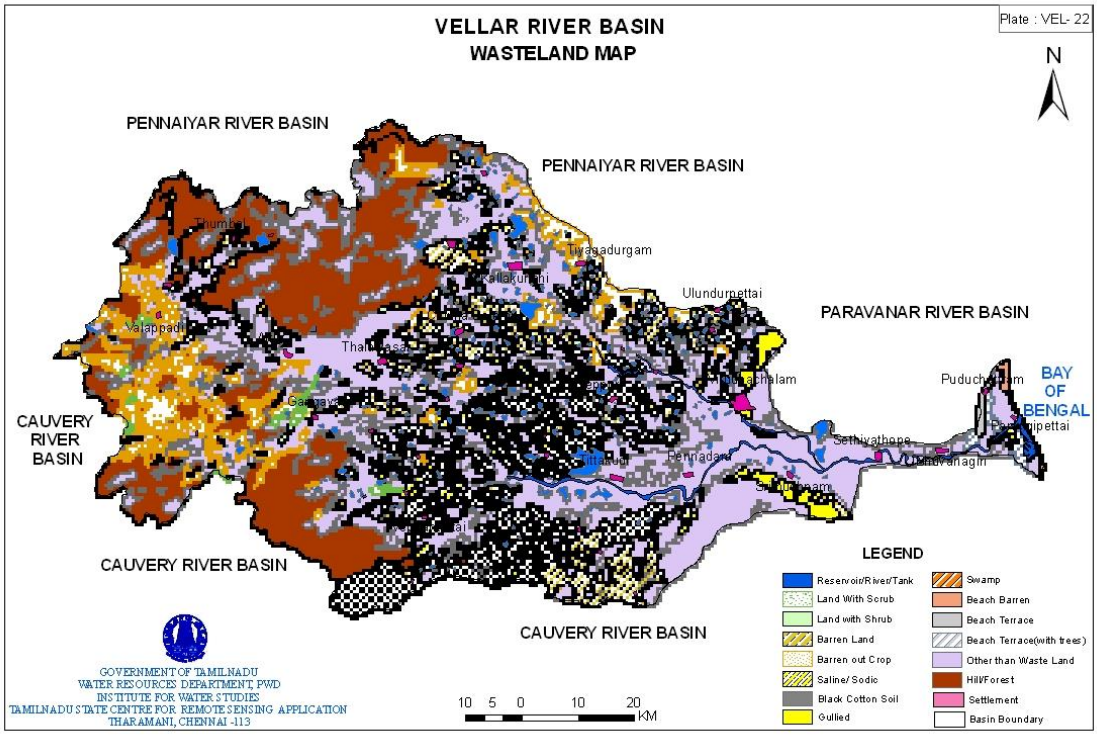

Figure 11 Wasteland Map of Vellar River Basin

Waste land is described as degraded land which can be brought under vegetative cover with reasonable effort and which is currently unutilized and land which is deteriorating for lack of appropriate water and soil management.

National Wastelands Development Board, (NWDB) has categorized waste land into 13 major categories. Out of the 13 categories, 11 categories of waste land are found in Vellar river basin and is shown in **Table 3.**

Table 3 Wasteland classification in Vellar River Basin

Sl. No.	Wasteland classification			Total Area in Sq.Km.	Percentage %
	Level I	Level II	Area in Sq.Km		
1	Wasteland	Land with scrub	24.296		0.52
		Land with shrub	10.496		0.14
		Barren land	674.222		8.99
		Barren out crop/ stony waste	432.336		5.76
		Saline/Sodic	237.425		3.17
		Gulley land	90.135		1.20
		Swamp / mangrove	6.488		0.09
		Beach barren	17.941		0.24
		Beach terrace	12.164		0.16
		Beach terrace with trees	30.215		0.40
		Block cotton soil	752.027		10.02
				2287.742	**30.49**
	Other than waste land			**5217.638**	**69.51**
			Total	**7504.346**	**100.00**

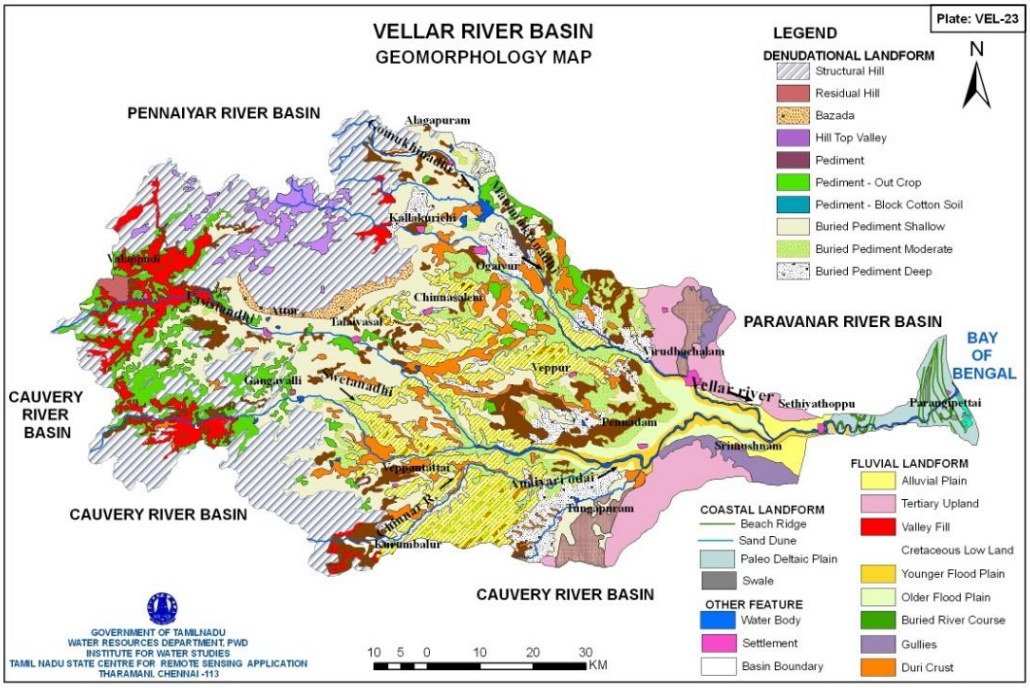

Figure 12 Geomorphological Map of Vellar River basin

The Vellar river basin area is occupied by hard rock (82%) comprising gneisses and charnockites on the western portion, which are sheared and show considerable weathering and fracturing. The sedimentary rocks occurring on the eastern part of the basin comprise of Cretaceous, Cuddalore sandstones alluvium and forming prominent water bearing formations.

In hard rocks area the depth of weathered zone range from 15m to 30m below ground level (bgl) and fractures extend upto 50m bgl. Normally rectangular type of wells, penetrating upto the bedrock is observed. Depth of dug wells varies from 10-35 m.bgl. Depending on the area whether in ayacut or non-ayacut areas the depth of the water table ranges from 5m to 35m m.bgl and is influenced by topography, geological and hydrogeological conditions. Dug wells upto a depth of 35m are located in Belur, Athur and Valapadi area. The hydraulic gradient of the water table in the hard rock formation is 2.75m per km. Recharge to groundwater takes place from precipitation and return flow of irrigated water and seepage from Canals. Narrow extent of alluvium occurs along Vasistanadhi near Attur. The transmissivity of the aquifer vary from 1 to 480 m^2 / day. The discharge of borewells in this area ranges from 60 to 80 lpm.

The Tertiary formation, (Cuddalore sandstones) is unconsolidated, intercalated with clay lenses. Groundwater occurs in phreatic and semi confined to confined conditions.

Discharge in boreholes in sandstone and granular zone area varies with depth as indicated below:

Depth in m.	**Discharge in lpm.**
100-250	200-900
250-500	1100-4500

Shallow dug wells, dug-cum-bore wells and medium tube wells are located in the clay bound sands of upper Cuddalore formation. Medium and deep bore wells are generally

constructed with the following potential zones in the sedimentary formation for ground water development.

- Upper zone 20 to 80mm bgl.
- Middle zone 90 to 180m bgl.
- Lower zone 200 to 275m bgl.

Alluvium of Vellar river is 3 to 6 km in width and thickness is 15 to 20m. Filter points are predominant in the coastal alluvium to tap ground water. Filter points also have been located at the bottom of shallow dug wells and centrifugal pumps are installed at the bottom of the well to draw groundwater.

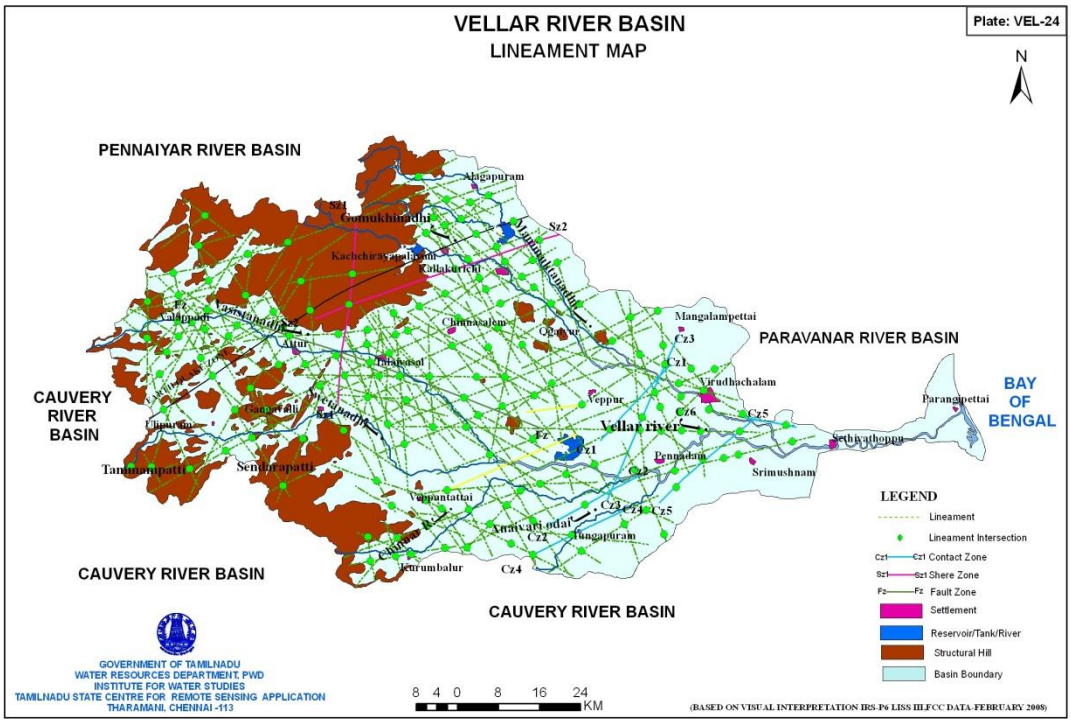

Figure 13 Lineament Map of the Vellar River Basin

The lineaments present in the Vellar basin are shown in the Figure. Nearly 210 lineaments were interpreted which includes 1 fault zone, 6 geological contact zones and 2 shear zones. The fault zone is located west of Willingdon reservoir and north of Attur town. Likewise the six geological contact zones are located in between Willingdon reservoir and Sethiyathope town in the east.

The lineament passing through the southern part of Gomukhi reservoir and northern side of Manimukthnadhi reservoir is running west of Kallakurichi, Attur and Tammampatti. The terrain displays many structural complexities developed by multiple deformations it had suffered. A prominent shear zone (SZ2) trending in NNE-SSW direction has been observed near the eastern foothills of the Kalrayan hills South West of Kallakurichi. The lineaments and lineament interaction points are feasible for further ground water development in Vellar river basin.

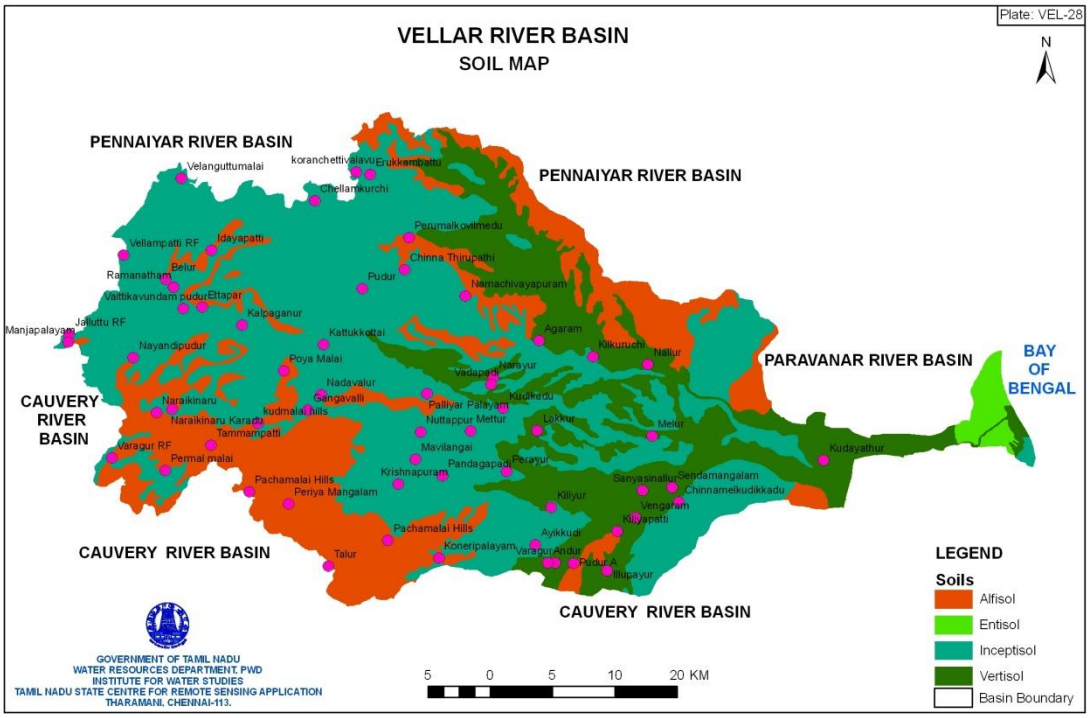

Figure 14 Soil Map of the Vellar River Basin

The Vellar river basin is mainly coimprised of Red Loam (Parts of Dharmapuri, Salem, Trichy, Cuddalore), Black Soil (Parts of Dharmapuri, Salem, Cuddalore) and Sandy Coastal Alluvium (On the coast of Cuddalore district).

Hydrometeorology

The study of hydrometeorology includes analysis of rainfall, temperature, humidity, wind speed, sunshine, evaporation and evapotranspiration. Rainfall is the most important parameter for water resources evaluation, planning and management of the resources. The entire command area of Vellar river basin depends upon the monsoon rainfall. If monsoon fails, entire command area will be in water deficit condition.

Table 4.8 Raingauge stations considered for Run-off analysis

S. No.	Name of subbasins	Subbasin area (Sq.Km.)	Raingauge stations
1	Vasista (or) Upper Vellar	1820.343	Athur, Rasipuram, Sankagiri
2	Swethanadhi	1042.890	Sendamangalam
3	Chinnar	649.680	Chettikulam, Thuraiyur
4	Anaivari Odai	340.447	Ariyalur

5	Gomukhinadhi	1147.230	Kattumailur, Gomukhi Reservoir
6	Manimukthanadhi	747.570	Manimuktha Reservoir
7	Lower Vellar	1756.186	Annamalai University, Chidambaram, Kilcheruvoi, Memathur, Pelandurai, Sethiathope, Srimushnam, Tholudur, Ulundurpet, Parangipettai, Virudhachalam, Kattumannaikoil, Kothuvacheri, Kuppanatham
	Total	**7504.346**	(or) 7504 Sq.Km.

Table 4 Dependable Rainfall (in mm)

Name of the Sub-basin	**25%**	**50%**	**75%**	**90%**
Upper Vellar	309.15	232.94	162.64	108.73
Swetha Nadhi	172.23	133.09	92.06	61.66
Chinnar	139.91	101.58	66.33	36.09
Anaivari Odai	82.84	63.82	51.56	36.69
Gomukhi	274.43	193.60	151.78	104.86
Manimuktha Nadhi	173.12	143.43	87.94	71.56
Lower Vellar	470.72	381.08	286.25	206.85

Rainfall in different regions

Physiographically, the Vellar Basin is divided into three divisions, viz., Western hilly terrain, Central hill valley complex terrain and Eastern deltaic plain and coastal region.

i) Western hilly terrain

The annual average rainfall ranges from 847 mm to 1057 mm in Manimuktha Nadhi sub basin to 1013 mm (Gomukhi Nadhi Sub-basin) and the average annual rainfall of the Upper Vellar sub-basin is 847mm.

ii) Central hill valley complex terrain

The central hill valley complex terrain covers southern part of Upper Vellar and northern part of Swetha Nadhi. The average elevation varies from 200m to 400m above MSL. The annual average rainfall in this region ranges between 847mm (Upper Vellar sub basin) to 835mm (Swetha Nadhi sub basin).

iii) Eastern deltaic plain and coastal region

The sub-basins covered in this terrain are Lower Vellar, Anaivari odai, Chinnar and southern part of Gomukhi Nadhi and Manimuktha Nadhi. The average elevation is varying from +100m in the west to +10m in the east. Rainfall increases towards the east and the Lower Vellar sub-basin receives 1177mm annual average rainfall.

The maximum, minimum and average annual rainfall for the seven sub basins are given in Table 6.

Table 6 Rainfall details of the Vellar Sub basins

SLNo	Name of the Sub-basin	No of influencing Rainguage Stations	Rainfall Range in mm (1971-2011)					Annual Average Rainfall in mm
			Annual	NE	SW	Winter	Summer	
1	Upper Vellar	5	1746 (1983-84) to 358 (1990-91)	994 to 71	606 to 130	58 to 0.0	312 to 21	846.70
2	Swetha Nadhi	7	1420 (1983-84) to 430 (1990-91)	672 to 103	500 to 130	68 to 0.0	327 to 34	834.60
3	Chinnar	7	1544 (2005-06) to 488(1990-91)	1132 to 179	645 to 168	133 to 0.0	384 to 17	987.30
4	Anaivari Odai	4	1792 (1977-78) to 642 (2002-03)	1354 to 251	597 to 216	201 to 0.0	417 to 4	1117.30
5	Gomukhinadhi	6	1671 (2005-06) to 491(1990-91)	1043 to 181	608 to 150	135 to 0.0	516 to 10	1013.40
6	Manimuktha Nadhi	4	1894 (2005-06) to 528 (1974-75)	1142 to 154	720 to 151	129 to 0.0	566 to 3	1056.50
7	Lower Vellar	16	1680 (1996-97) to 672 (1982-83)	1164 to 295	598 to 204	244 to 0.0	372 to 4	1177.60

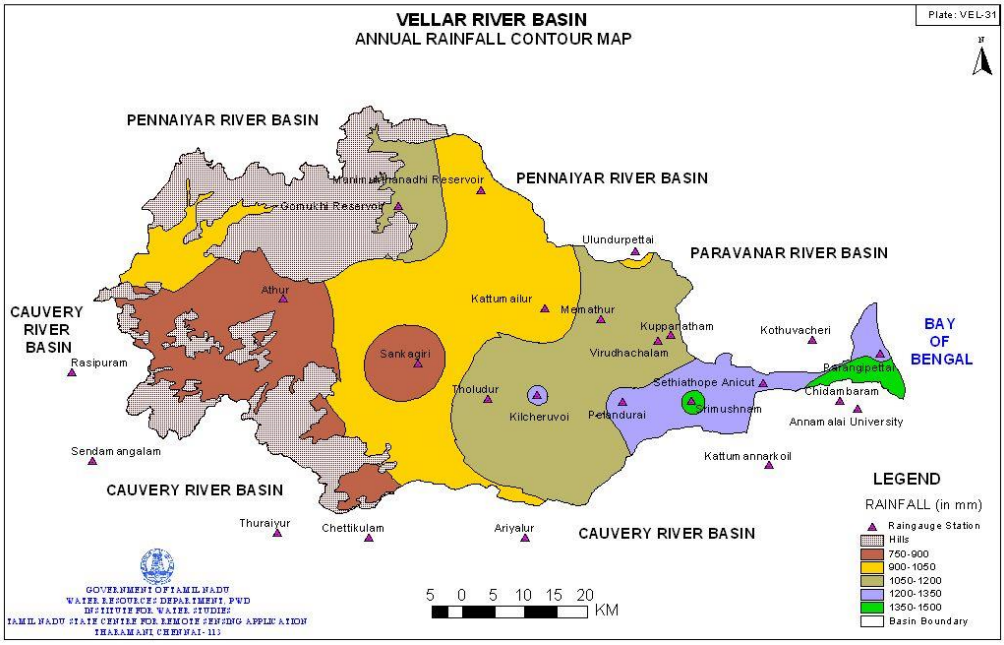

Figure 15 Annual Rainfall Contour Map of Vellar Basin

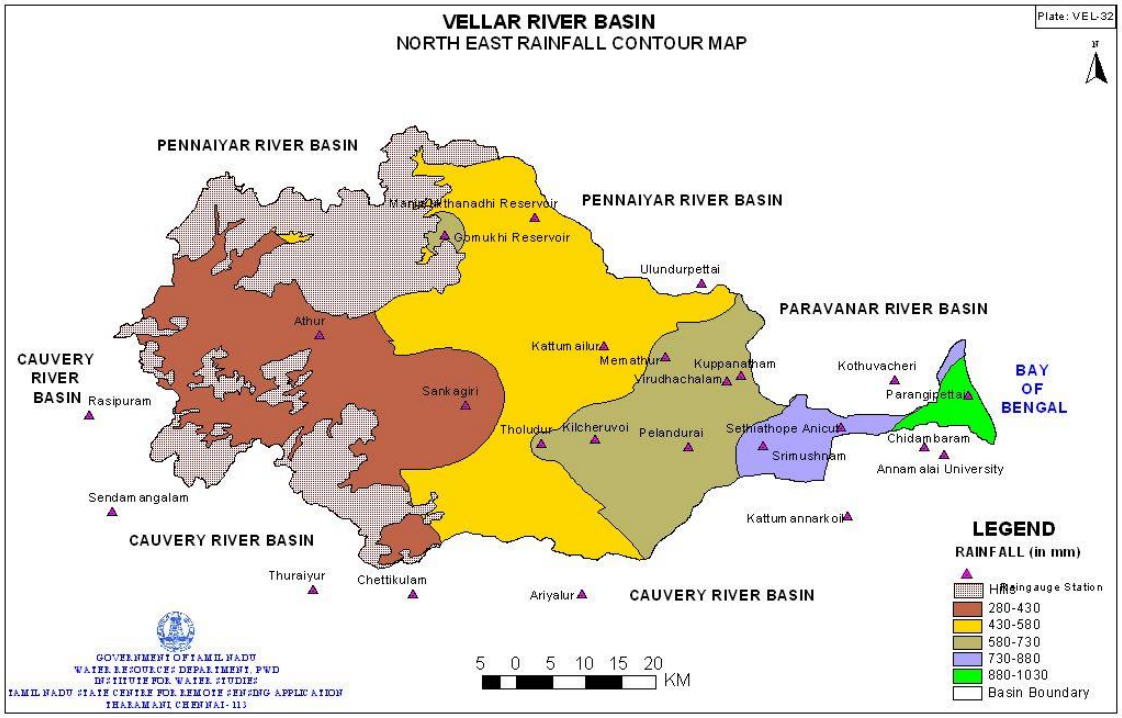

Figure 16 North East Rainfall Contour Map

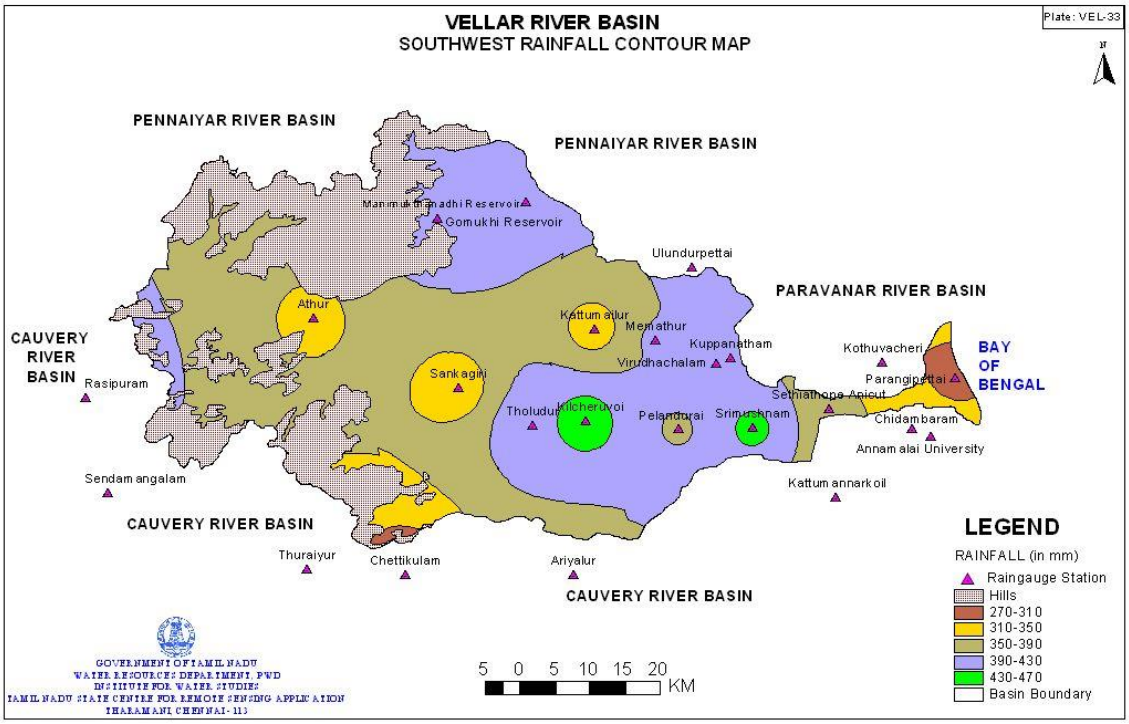

Figure 17 Southwest Rainfall Contour Map

The climatological parameters of the Vellar basin are computed based on two weather stations (Lekkur and Mangalapuram) representing Lower Vellar and Upper Vellar. The parameters are given in Table 7 below.

Table 7 Climatological Parameters of the Vellar basin

Sl. No.	Climatological Parameter	Lekkur	Mangalapuram
1	Average monthly temperature Maximum in ^{0} Celsius	34.20	33.14
2	Average monthly temperature Minimum in ^{0} Celsius	25.32	25.33
3	Average mean temperature in ^{0} Celsius	29.76	29.24
4	Average relative humidity in %	64.72	64.44
5	Average wind velocity in km/hour	2.85	3.85
6	Average Sunshine hours / day	6.68	7.35
7	Pan Evaporation in mm/month	167.71	181.33

Eto values (mm/month) of FCS for Vellar basin													
Name of the basin & FCS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**Average**
Vellar basin - Mangalapuram FCS	115.0	127.4	157.2	173.4	168.6	147.3	137.6	137.6	131.7	115.0	95.7	97.0	133.6
Vellar basin - Lekkur FCS	129.0	138.0	180.4	192.6	206.2	192.0	176.1	173.3	150.9	129.3	108.6	114.4	157.6

Surface Water Potential

The Vellar river flow diagram is given in Figure18.

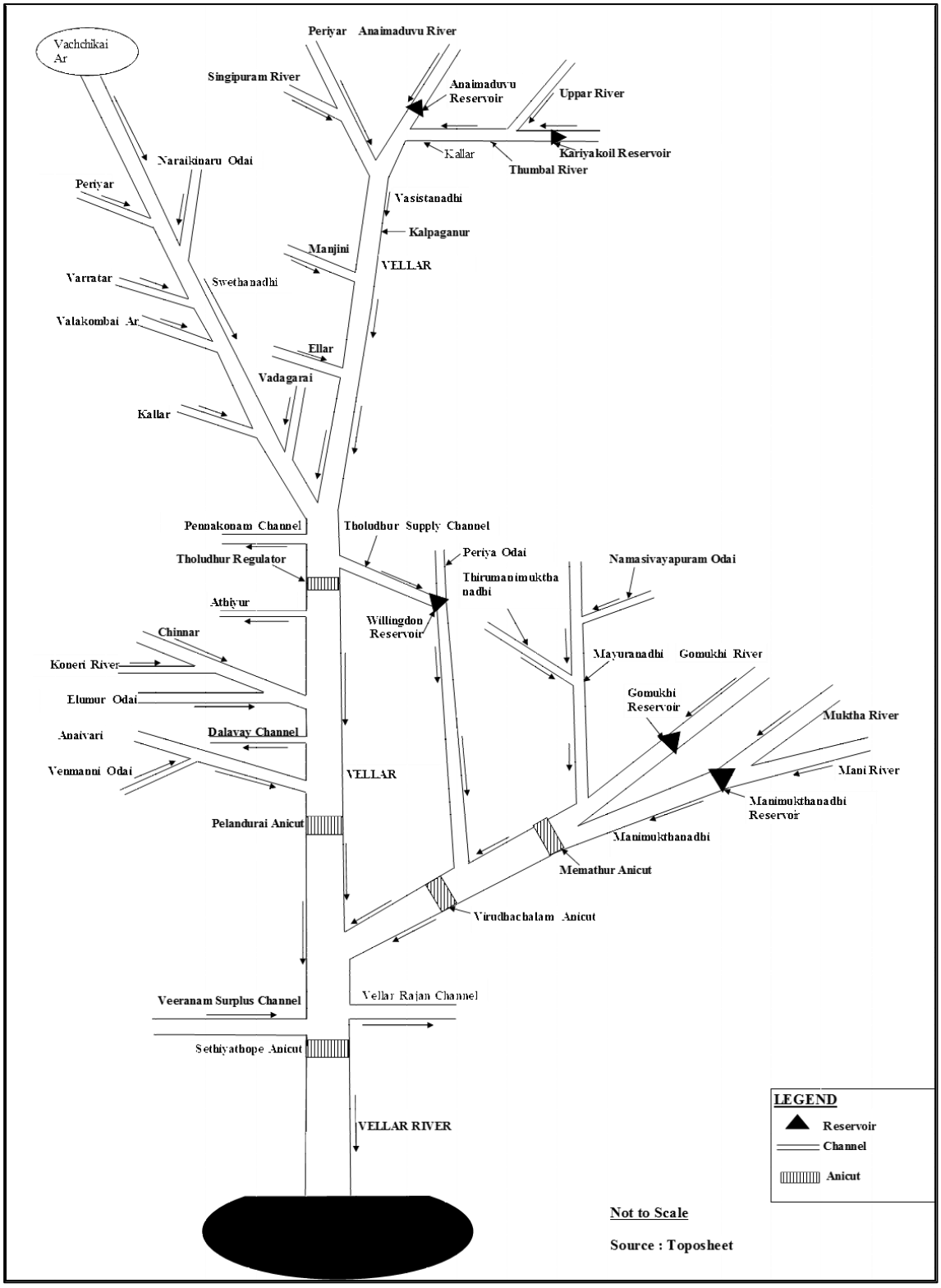

Figure 18 Flow Diagram of the Vellar River Basin

Surface Water data

In Vellar basin, the river flows are measured at 10 places. They are 1.Anaimaduvu reservoir 2.Kariyakoil reservoir 3.Gomukhi reservoir 4.Manimukthanadhi reservoir 5.Willingdon reservoir 6.Tholudur regulator 7.Pelandurai anicut 8. Memathur anicut 9. Virudhachalam anicut and 10. Sethiyathope anicut. Also flow is being measured at Kudalaiyathur GD site, maintained by the Central Water Commission. The discharge details of 4 anicuts are given. The maximum annual discharge for the following periods of the 4 anicuts are given.The maximum annual discharge for the period of 20 years for the Kudalaiathur Gauging site is given. For the three anicuts (Memathur, Vridhachalam, Sethiyathope), monthly outflow for a period ranging from 24-32 years is given.

In the Vellar basin, the surface water is drawn for usage from reservoirs, anicuts and tanks. There are 5 reservoirs in the basin having a total ayacut of 18384.86 Ha. The details are given below.

S. No.	Name of the Reservoir	Name of the Sub Basin	Gross capacity in Mcum	Direct Ayacut in Ha	Indirect Ayacut in Ha
1.	Anaimaduvu Reservoir	Upper Vellar	7.56	2029.03	-
2.	Kariyakoil Reservoir		5.38	1457.49	-
3.	Gomukhi Reservoir	Gomukhinadhi	15.88	2024.29	-
4.	Manimukthanadhi Reservoir	Manimukthanadhi	20.87	1720.65	-
5.	Willingdon Reservoir	Lower Vellar	73.06	10484.00	669.40
	Total		**122.75**	**17715.46**	**669.40**

Table 8 Reservoirs in Vellar Basin

There are totally 236 anicuts including one regulator in the Vellar basin. The four major anicuts and one regulator are located in the lower Vellar sub-basin. The major anicuts and ayacuts details are given below.

Table 9 Major Anicuts and Regulator in Vellar river Basin

S. No.	Name of Anicut / Regulator	Ayacut in ha
1.	Tholudhur Regulator	735.40
2.	Pelandurai Anicut	4731.14
3.	Memathur Anicut	1970.69
4.	Virudhachalam Anicut	3811.19
5.	Sethiyathope Anicut (Ayacut in	8989.89

	Vellar basin)(Ayacut in Paravanar basin = 9179.12 Ha)	
6.	Tholudhur regulator system	11219.4
	Total	**31457.71**

There are about 406 tanks, out of which 276 tanks are system tanks and 130 tanks are nonsystem tanks. The non-system tanks use surface water of the direct runoff from their own catchment, whereas the system tanks are filled from the canal flow diverted by the anicuts across the river apart from the direct runoff from their own catchment. The total storage capacity of these tanks is 170.12 Mcum and the total ayacut benefitted is 32577.99 Ha.

The tank details of the Vellar river basin are given below.

Table 10 Tank Details of Vellar River Basin

Sl. No	Name of the Sub basin	Area of the Sub basin	System Tanks			Non - system Tanks			Total Tanks		
			Nos	Capacity in Mcum	Ayacut in Ha	Nos	Capacity in Mcum	Ayacut in Ha	Nos	Capacity in Mcum	Ayacut in Ha
1	Upper Vellar (or) Vasistanadhi	1820.34	39	17.51	2882.73	11	5.03	827.93	50	22.54	3710.66
2	Swethanadhi	1042.89	30	13.90	2577.43	5	2.20	392.73	35	16.10	2970.16
3	Chinnar	649.68	25	12.27	2070.06	11	7.75	1126.13	36	20.02	3196.19
4	Anaivari Odai	340.47	9	1.49	228.26	9	4.40	628.22	18	5.89	856.48
5	Gomukhinadhi	1147.23	64	23.93	3710.43	32	12.84	1814.35	96	36.77	5524.78
6	Manimukthanadhi	747.57	31	12.66	1756.19	20	10.70	1488.18	51	23.26	3244.37
7	Lower Vellar	1756.18	78	30.67	9945.88	42	14.77	3129.47	120	45.44	13075.4
	Total	**7504.36**	**276**	**112.43**	**23170.98**	**130**	**57.69**	**9407.01**	**406**	**170.12**	**32577.99**

Surface Water potential:

Vellar basin is a medium river basin with a drainage area of 7504.346 Sq.Km. Surface water run-off is computed by three methods.

A. Rainfall-runoff coefficient method

In this method, a coefficient of 0.15 for the plains and 0.20 for hilly terrains was used to arrive at the basin yield.

B. Surface water potential by Monthly Runoff Simulation (MRS) model

The surface water potential arrived from MRS Model is given in the **Table 4.11**.

C. Surface water potential by NWDA Approach

Table 4.11 75% Dependable Surface Water Potential for the Vellar River Basin

Sl. No.	Name of Sub basin	75% Dependable Surface Water Potential in Mcum			
		SW	NE	NM	Annual
1	Upper Vellar	48.19	80.11	34.34	162.64
2	Swethanadhi	45.15	23.40	23.51	92.06
3	Chinnar	19.38	32.91	14.04	66.33
4	Anaivari Odai	17.58	30.60	3.38	51.56
5	Gomukhinadhi	49.21	75.46	27.11	151.78
6	Manimukthanadhi	30.28	53.35	4.32	87.94
7	Lower Vellar	85.88	172.54	27.83	286.25
Total		**295.67**	**468.37**	**134.53**	**898.56**
South West Monsoon Potential		**295.67 (or) 296 Mcum**			
North East Monsoon Potential		**468.37 (or) 468 Mcum**			
Non Monsoon Potential		**134.53 (or) 135 Mcum**			
Annual Potential		**898.56 (or) 899 Mcum**			

Surface Water Potential of Vellar Basin is 899 Mcum at 75% dependability.

<u>Groundwater potential in Vellar River basin</u>

Table 11 presents the number of wells in every sub basin of Vellar Basin and the geological formations in which these wells are sunk.

Table 11 Number of observation wells in geological formations

S. No.	Sub Basin	Geological formations & no. of observation wells					
		CNK	GGN	GNS	GRT	SDM	SST
1	Upper Vellar	22	9	-	-	-	-
2	Swetha Nadhi	7	2	-	-	-	-
3	Chinnar	5	-	-	-	2	-
4	Anaivari Odai	-	-	-	-	1	2

5	Gomukhinadhi	4	3	2	1	-	-
6	Manimuktha Nadhi	1	2	4	-	-	-
7	Lower Vellar	-	7	-	-	22	-
	Total	**39**	**23**	**6**	**1**	**25**	**2**

Note:

CNK - Charnockite
GRT - Granite
GGN - Granitic Gneiss
SDM - Sand Medium
GNS - Gneiss
SST - Sandstone

The district wise groundwater potential calculation as on March 2013 is presented in **Table 12.**

Table 12 Ground Water Potential Calculation as on MARCH 2013

Name of District covered	Area covered in %	Net Annual Ground water available in Ha m	Ground water potential District wise in Ha m
CUDDALORE	21.41	128495.06	27510.79
VILLUPURAM	24.12	148771	35883.57
SALEM	27.13	54609.38	14815.52
PERAMBALUR	14.83	21510.24	3189.97
NAMAKKAL	4.30	36411.04	1565.67
ARIYALUR	5.05	35251.72	1780.21
TIRUCHIRAPPALLI	1.75	70069.09	1226.21
DHARMAPURI	1.40	36669.66	513.38
		Total	**86485.32 Ha.m**
			864.85 M.cum

Sub-basin wise groundwater level fluctuations are given in the table 13 below.

Table 13 Sub Basin-wise Fluctuations

S. No.	Name of Sub Basin	Highest Seasonal Fluctuation			
		Minimum in m	During the year	Maximum in m	During the year
1	Upper Vellar	0.30	76-77	33.59	05-06
2	Swetha Nadhi	0.77	90-91	21.97	05-06
3	Chinnar	0.69	76-77	12.70	96-97
4	Anaivari Odai	1.02	06-07	13.60	91-92
5	Gomukhi Nadhi	0.73	03-04	20.34	05-06
6	Manimuktha Nadhi	1.28	00-01	11.23	05-06
7	Lower Vellar	0.47	74-75	25.96	96-97

Table 14 Change in Classification of the Blocks based on the level of Ground Water Development

S. No.	Block	District	Categorisation of Block (2003)	Categorisation of Block (2009)
1	Pappireddipatti	Dharmapuri	Over Exploited	Over Exploited
2	Athur	Salem	Over Exploited	Over Exploited
3	Ayothyapattinam		Over Exploited	Over Exploited
4	Gangavalli		Over Exploited	Over Exploited
5	Panaimarathupatti		Over Exploited	Over Exploited
6	Peddanaickanpalayam		Over Exploited	Critical
7	Thalaivasal		Over Exploited	Over Exploited
8	Vazhapadi		Over Exploited	Over Exploited
9	Kollimalai	Namakkal	Safe	Safe
10	Namagiripettai		Over Exploited	Over Exploited
11	Sendamangalam		Over Exploited	Over Exploited
12	Vennandur		Over Exploited	Over Exploited
13	Thuraiyur	Trichy	Over Exploited	Over Exploited
14	Uppiliyapuram		Over Exploited	Over Exploited
15	Alathur	Perambalur	Over Exploited	Over Exploited
16	Perambalur		Over Exploited	Over Exploited
17	Veppanthattai		Over Exploited	Over Exploited
18	Veppur		Over Exploited	Over Exploited
19	Andimadam	Ariyalur	Safe	Safe
20	Ariyalur		Semi Critical	Safe
21	Jayankondam		Safe	Safe
22	Sendurai		Safe	Safe

23	Chinna Selam	Villupuram	Semi Critical	Safe
24	Kallakurichi		Critical	Safe
25	Kalrayan Hills		Safe	Safe
26	Rishivandiyam		Over Exploited	Semi Critical
27	Sankarapuram		Over Exploited	Semi Critical
28	Thirunavalur		Critical	Safe
29	**Thiyagadurgam**		**Semi Critical**	**Over Exploited**
30	Ulundurpettai		Over Exploited	Over Exploited
31	**Kammapuram**	Cuddalore	**Semi Critical**	**Over Exploited**
32	Kattumannarkoil		Semi Critical	Safe
33	Keerapalayam		Safe	Safe
34	Kumaratchi		Safe	Safe
35	Kurinjipadi		Semi Critical	Safe
36	Mangalur		Semi Critical	Safe
37	Melbhuvanagiri		Semi Critical	Semi Critical
38	Nallur		Over Exploited	Safe
39	Parangipettai		Safe	Safe
40	Virudhachalam		Semi Critical	Safe

Comparison of stage of groundwater development in 2003 (as given in Micro Level Study of Vellar Basin) with 2009 classification reveals that categorization of twenty-six blocks remains unchanged. Groundwater development has worsened from 'semi critical' to 'over exploited' in two blocks namely, Kammapuram and Thiyagadurgam. All other twelve blocks in this basin have shown improvement.

The aquifer parameters of the Vellar river basin are given below.

Table 15 Aquifer parameters in Hard Rocks

S. No.	Parameter	Minimum	Maximum
1.	Specific Capacity (lpm/m draw down)	2.00	90
2.	Transmissivity (T) (m^2/day)	3.00	280
3.	Storage Co-efficient (S)	1.00/ 1000000	4.00/100000
4.	Well Yield (liters per minute)	9.00	1280

Table 16 Aquifer parameters in Sedimentary Rocks

S. No.	Parameter	Minimum	Maximum
1.	Specific Capacity (lpm/m draw down)	100	1200
2.	Transmissivity (T) (m^2/day)	13	1626

3.	Storage Co-efficient (S)	1.10/100000	4.70/100000
4.	Well Yield (liters per minute)	159	1818

Present and future water demand

Irrigation demand:

Existing Cropping pattern in Vellar Basin

The major crops cultivated in the Vellar Basin are paddy and sugarcane. The other minor crops grown in this basin are maize, turmeric, fruits & vegetables, cotton, coconut, pulses and groundnut. The present irrigated area in Vellar River basin under different crops is 2,14,636 hectares. Under irrigated conditions, Paddy (1, 04,546 ha) is the main crop irrigated in this basin followed by Sugarcane (34,492 ha). In the remaining area, minor crops are cultivated. Irrigated crops rose with surface water and groundwater or both are considered for calculating the crop water requirement Rainfed crops are not considered for calculating the crop water requirements. Figure 19 gives the sub basin wise irrigated area of crops in the Vellar Basin.

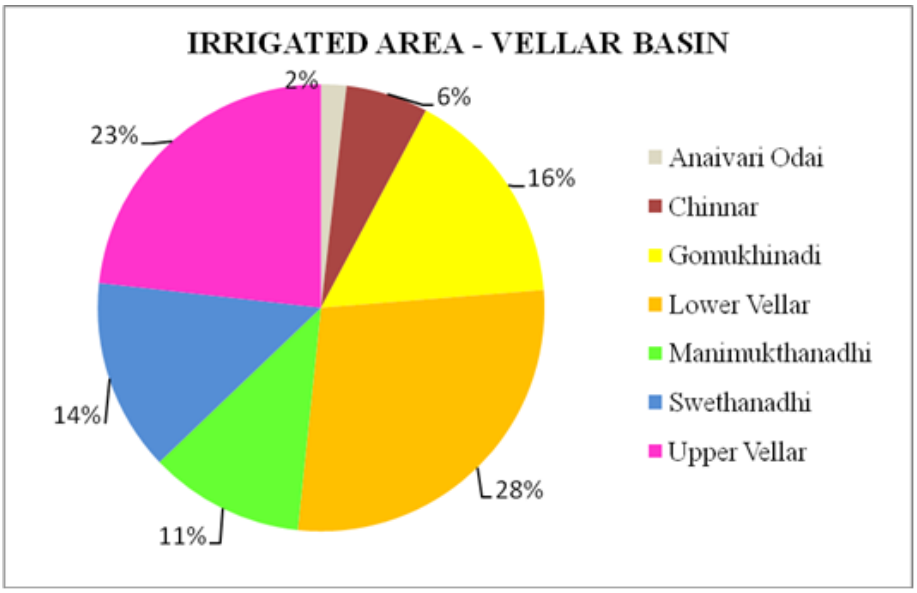

Figure 17 Total Irrigated Area in Vellar Basin

Water demand in Vellar river basin

Total water demand is the sum of the sectoral demands such as domestic demand, irrigation demand, livestock demand and industrial demand.

Domestic water demand:

Domestic demand is calculated from the population of Vellar river basin. Exponential growth formula is adopted for estimating the population growth.

Table Projected Domestic water demand

Year		Population	Demand		
			in MLD	in MLD	in Mcm
2011	Urban	341645	26.63	171.5	62.6
	Rural	3622000	144.88		
2017	Urban	384748	29.99	193.1	70.5
	Rural	4078960	163.1584		
2020	Urban	408297	31.82	194.6	71.01
	Rural	4068492	162.73968		
2030	Urban	497712	38.79	224	81.75
	Rural	4629434	185.17736		
2040	Urban	606709	47.29	258	94.17
	Rural	5267716	210.70864		
2050	Urban	832881	64.91	304.7	111.2
	Rural	5994001	239.76004		

Industrial water demand

Industrial water demand is calculated based on the requirement of Small, Medium and Large scale industries in the basin. The recommendations of the industries department i.e., 2500 cum/day/unit for large and medium scale industries and 2.5 cum/day/unit for small scale industries are adopted for estimating the industrial demand.

Table WATER DEMAND CALCULATION FOR SMALL, MEDIUM AND LARGE INDUSTRIES BASED ON INDUSTRY CENSUS AS TAKEN FROM IWS FOR VELLAR BASIN

Sl. No.	Type of industry	Average Rate of Water consumption as given in IWS m^3/day	2010		2017		2020		2030		2040		2050	
			No. of industry as per IWS	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand	No. of industry	Water Demand
1	Small scale industry	2.5	39163	35.74	**67118**	61.25	**84550**	77.15	**182537**	166.57	**394084**	359.60	**850797**	776.35
2	Medium & large scale industry	2500	39	35.59	**67**	60.99	**84**	76.83	**182**	165.87	**392**	358.10	**847**	773.12
Total Demand in M.Cum				**71.32**		**122.24**		**153.98**		**332.44**		**717.71**		**1549.47**

Livestock water demand

The projected livestock water demand is given in Table

Table Livestock water demand for Vellar Basin

Sl. No.	Name	Standard Norms in lpcd	Demand 2017	Demand 2020	Demand 2030	Demand 2040	Demand 2050
1	Cattle	110	14.59	14.78	15.41	16.07	16.76
2	Buffalo	150	0.32	0.28	0.18	0.12	0.07
3	Sheep	20	0.43	0.43	0.43	0.43	0.43
4	Goats	20	2.35	2.35	2.32	2.3	2.28
5	Horses & Ponies	150	0.02	0.02	0.02	0.03	0.03
6	Donkeys	40	0.003	0.003	0.003	0.003	0.003
7	Pigs	40	0.226	0.226	0.226	0.226	0.226
8	Dogs	15	0.239	0.239	0.239	0.239	0.239
9	Rabbits	15	0	0	0	0	0
10	Poultry	0.25	0.087	0.087	0.087	0.087	0.087
	Total		18.2648032	18.414803	18.9148	19.5048	20.1248

Table 21Water Balancing for Vellar River Basin

Sl. No	Name of the basin	Area of the basin (in Sq.Km)	No. of Sub basins	Year	Demand of water in various sectors (MCM)						Water availabilty (MCM)					Surplus / Deficit in Mcum
					Irrigation	Domestics	Industries	Live stock	Others	Total	Surface water potential	Ground water potential as march 2013	Quantity of recycled water from Sewage	Quantity of water from desilting	Total	
1	VELLAR	7530.530	7	2017	1672.00	70.50	122.236	18.26	-	1883.00	981.00	864.85	-	29.532	1875.39	-7.62
				2020	1672.00	71.01	153.98	18.41	-	1915.41	981.00	864.85	-	29.532	1875.39	-40.02
				2030	1672.00	81.75	332.44	18.91	-	2105.10	981.00	864.85	-	29.532	1875.39	-229.72
				2040	1672.00	94.17	717.71	19.50	-	2503.38	981.00	864.85	-	29.532	1875.39	-628.00
				2050	1672.00	111.20	1549.47	20.12	-	3352.80	981.00	864.85	-	29.532	1875.39	-1477.41