

**CHAPTER 4.1.9 GROUND WATER RESOURCES  
SIVAGANGAI DISTRICT**

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## **GROUND WATER REPORT OF SIVAGANGAI DISTRICT**

### **INTRODUCTION :**

In Tamil Nadu, the surface water resources are fully utilized by various stake holders. The demand of water is increasing day by day. So, groundwater resources play a vital role for additional demand by farmers and Industries and domestic usage leads to rapid development of groundwater. About 63% of available groundwater resources are now being used. However, the development is not uniform all over the State, and in certain districts of Tamil Nadu, intensive groundwater development had led to declining water levels, increasing trend of Over Exploited and Critical Firkas, saline water intrusion, etc.

### **ADMINISTRATIVE SET UP**

The geographical extent of Sivagangai District is 4, 18,900 hectares or 4,189 sq.km. Accounting for 3.22% of the geographical area of Tamilnadu State. The district has well laidout roads and railway lines connecting all major towns within and outside the State for administrative purpose. For administrative purpose , the district has been divided into 6 Taluks, 12 Blocks and 38 Firkas. Sivagangai is a major town and district headquarters shown in Map-1

Sivagangai district has three Municipalities i.e Karaikudi, Sivagangai and Devakottai, Sivagangai district falls between the following co-ordinates.

Latitude : 09°31'00" - 10°25' 00" N and

Longitude: 78°08'00"- 79°01'00"

Sivagangai District is totally bifurcated into 38 Firkas.

### **1. HYDROGEOLOGY**

#### **(i) Major Geological formations:**

##### **Geology**

The district is underlain by the formations of quaternary, tertiary, mesozoic and andazoic area.

The western and north western part of the district comprising the western part of the Sivagangataluk and major part of Thirupathurtaluk are occupied by crystalline rocks of Archaean age which includes number of rock types namely feldspathic and mica gneiss, charnockites, quartzites, pegmatites and granitic intrusions.

Overlying the above formations the upper Gondwana exposures are prominent in the north east – southwest trending belt near Sivagangai extending from Kallal to sivagangai and beyond in the southern part of the district. The lateritic capping in karaikudi taluk further north has been observed with its further continuity beyond kallal. However, the study of well section around Managiri, Koviloor and Talakavoor villages shows red yellow and purple shells which are generally fine grained and fossils showing horizontal bedding.

The lower as well as upper cretaceous formations do not crop out anywhere in the district and are encountered in the bore holes only. The formations suggestive of lower cretaceous are encountered in the bore holes drilled by ONGC near Karaikudi below 128m below ground level, comprises alternate layers of clay and shale with sandstone. The clay and shale are grey to black in colour. The sandstone is medium to coarse grained greenish and admixes with clay.

The formations suggestive of upper cretaceous are encountered in the bore holes drilled in the eastern part of the district only, east of Devakottai namely in Sathanaikottai, Kappalur etc., occurring between 200m and 295m BGL.

The formation suggestive of Eocene or Palaeocene occurs in the eastern part of the district and are encountered in the bore holes drilled at Sathanaikottai, Kappalur, Devandathavu and at Neyvayal occurring between depth ranges 77m and 190 m BGL with maximum thickness of 82 m and consist mainly of clay and shale, dark greenish to black with shale or sand and sand stone lenses. Exposures of tertiary (Mio-pliocene age) formations are seen around Karaikudi, Sengarai, Sakkottai, Kottaiyur, Kalayarkoil and Manamadurai. The alluvial formation brought down by the river draining the district are found in major part of Karaikudi and to a smaller extent along the river course in Thirupattur taluk. It consists of clay, sandy clay, silky clays, sand and gravel with thickness ranging between 6m and 40m.

The area covered by various formations of this district is tabulated as follows:

<b>Sl.No.</b>	<b>Formation</b>	<b>Area covered in Sq.Km.</b>
1.	Alluvium	1384
2.	Tertiary	1165
3.	Gondwana	302
4.	Hard rock	1338
	Total area	4189

#### Drilling of bore holes:

The occurrence and movement of groundwater in hard rock formations are restricted to open system of fractures like fissures and joints and also in the porous zones of weathered formations.

Generally, in hard rock regions occurrence of weathered layer is discontinuous both in space and depth. Hence, recharge in hard rock formations is influenced by the intensity of weathering. The sub surface conditions can be ascertained by drilling exploratory bore holes and conducting pump tests.

The ground water wing during the course of investigations has drilled more than 343 bore holes spread over the entire district to find out the nature and behaviour of the sub surface material. There is considerable diversity in the nature of formations even within the short distance. In Singampunari and Thirupattur blocks, the weathering zone varies between 30m to 40m below ground level.

Aquifer parameters:

a) Hard rock

The thickness of aquifer in this district is highly erratic and varies between 20m and 50m below ground level. The inter granular porosity is essentially depending upon the intensity and degree of weathering and fracture development in the bed rock. The range of aquifer parameters in hard rock regions are given below.

<b>Parameters</b>	<b>Range</b>
Well yield in LPM	50-150lpm
Transmissivity (T) m <sup>2</sup> /day	20-70 m <sup>2</sup> /day
Permeability (K) m/day	1.02-2.54 m/day

Source: Ground water division, Karaikudi

b) Sedimentary formation

The sedimentary formation in Sivagangai district comprises of Alluvium, tertiary and gondwana. The range of aquifer parameters for alluvium are furnished below.

<b>Parameters</b>	<b>Range</b>
Well yield in LPM	400-2200lpm
Transmissivity (T) m <sup>2</sup> /day	300-2500 m <sup>2</sup> /day
Permeability (K) m/day	20.45-64.45 m/day

Source: Groundwater division, Karaikudi

### **(iii) Drilling:**

The drilling types are different according to the formation of the terrain. In general, DTH rigs are used in Hard rock formations for drilling a borewell at a depth ranges from 30m to 200m, according to the extension of joints, fractures, lineaments, etc in an area. In Sedimentary formations, rotary rigs with different rotors used according to the Tube well's diameter. The Bentonite clay is used in rotary rigs to avoid the collapse of the Tube well. The sedimentary tube wells are drilled up to a depth of 30m to 300m depending on the area, yield, etc. In alluvial formations, the hand rotary used for drilling tube wells ranges from 10m to 15m. In river beds, infiltration tube wells used for extraction of groundwater.

In Hard rock, the well designing is simple. The upper top soil and highly weathered zone is cased with PVC pipe and the remaining weathered, Fissured, Jointed portion is left as it is. In Villupuram District, the weathered zone ranges from 1.0m to 12.0m. In Granitic gneiss area, the highly weathered portion will be more up to 15m but in charnockite area, the weathered zone will extend up to 8.0m to 10.m only. In Sedimentary area, the well construction depends on the occurrence of sand thickness in the referred area. The logger is also used in the construction to identify the area of good quality of water.

## **2. GROUNDWATER REGIME MONITORING:**

### **(i) Notes on existing water level scenario:**

The water level is being monitored by State Ground & Surface Water Resources Data Centre from 1971 onwards from a network of 1746 observation wells (shallow open wells) located all over the State. The water level readings are observed in the first week of every month by the field officers. In Sivagangai District, 196 observation wells and 42 piezometers, totally 238 wells are monitoring on Monthly basis. The Central Ground Water Board also monitors the water level from 900 numbers of wells spread all over the State. They observe water level four times in a year. ( i.e January, May, August and November). The collected water level data are uploaded in GWDES software and database is maintained regularly for analysing the water level trend with rainfall. From the Monitoring network of wells, the selected representative wells are taken for Resource Estimation computations.

In Sivagangai District, during the pre monsoon, the water level generally in

declining trend ranges from G.L. to 15m. The depth of well below GroundLevel 12.0m are become dry during hot season like May, June, July. In the post monsoon, the water level generally in upward trend due to rainfall and it may reach the Ground Level also. The water level trend maps for pre and post monsoons are included as Annexure- I & II.

**(ii) Long term trend of water level:**

The long term fluctuations of water levels range from G.L. to 14.0m in many parts of the Sivagangai District. The analysis reveals that the water level has gone down in the north, west and central parts of the Sivagangai District. The inference taken from the annual fluctuation is due to lack of rainfall which in turn affects the groundwater levels in phreatic aquifer. The seasonal fluctuation study reveals that due to necessity for development of ground water for different sector needs and due to failure of monsoons, the water level has gone down. The hydrograph of observation wells water level trend from 2005 to 2017 enclosed as Annexure – III and water level trend from 2000 to 2017 of Piezometers enclosed as Annexure – IV for Sivagangai District.

**(iii) Existing network of Monitoring wells:**

In Sivagangai District, the existing network of monitoring wells is 238 wells, 196 wells are observation wells and 42 wells are piezometers. These wells are observed for every month water level.

**Sivagangai District: Observation Wells - Location and Co-ordinates**

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
26001	Sivagangai	Devakottai	Devakottai	Thiruppakottai	09°48'49"	78°40' "
504001	Sivagangai	Devakottai	Devakottai	Kandadevi	09°58'34"	78°49'24"
504002	Sivagangai	Devakottai	Devakottai	Odappanpatti	09°57'27"	78°47'24"
504003	Sivagangai	Devakottai	Devakottai	Nachankulam	09°55'45"	78°44'45"
504004	Sivagangai	Devakottai		Udaiyachi	09°56'44"	78°48'27"
504005	Sivagangai	Devakottai		Elamanur	09°32'58"	78°38'41"



504006	Sivagangai	Ilanyangudi	Ilanyangudi	Kachathanallur	09°32'39"	78°32'58"
504007	Sivagangai	Ilanyangudi	Ilanyangudi	Karaikudi.S	09°39'03"	78°30'57"
504008	Sivagangai	Ilanyangudi		Thiruvedaiyar Puram	09°35'39"	78°37'03"
504009	Sivagangai	Ilanyangudi	Ilanyangudi	Serupalai	09°35'23"	78°39'22"
504010	Sivagangai	Ilanyangudi	Ilanyangudi	Andakudi	09°34'05"	78°40'49"
504011	Sivagangai	Ilanyangudi	Ilanyangudi	Sathanur	09°36'07"	78°47'08"
504012	Sivagangai	Ilanyangudi	Ilanyangudi	Vadakkuvandal	09°38'45"	78°46'57"
504013	Sivagangai	Ilanyangudi	Ilanyangudi	Vadavirukkai	09°40'20"	78°45'59"
504014	Sivagangai	Karaikudi	Sakkottai	Sakkottai	10°05'42"	78°51'10"
504015	Sivagangai	Karaikudi	Sakkottai	Pallathur	10°07'44"	78°47'40"
504016	Sivagangai	Karaikudi	Sakkottai	Sekkalai	10°05'06"	78°46'38"
504017	Sivagangai	Karaikudi	Sakkottai	Kovilur	10°04'58"	78°44'43"
504018	Sivagangai	Karaikudi	Kallal	Elangudi	10°04'12"	78°41'48"
504019	Sivagangai	Tiruppathur		Seravayal	10°06'19"	78°39'42"
504020	Sivagangai	Tiruppathur		Vairavanpatti	10°07'45"	78°29'26"
504021	Sivagangai	Karaikudi		Kundrakudi	10°06'52"	78°41'56"
504022	Sivagangai	Karaikudi		Alathupatti	10°08'14"	78°44'45"
504023	Sivagangai	Karaikudi		Atthankudi(mett uppatti)	10°09'29"	78°44'05"
504024	Sivagangai	Karaikudi		Poovandipatti	10°09'09"	78°45'45"
504025	Sivagangai	Karaikudi	Sakkottai	Pazghiyur	10°10'46"	78°46'46"
504026	Sivagangai	Karaikudi	Sakkottai	Kothamangala m	10°11'57"	78°48'28"
504027	Sivagangai	Karaikudi		Kallankudi	10°07'31"	78°49'14"

504028	Sivagangai	Karaikudi	Saskkottai	Veerasekarapuram	10°06'23"	78°52'49"
504029	Sivagangai	Karaikudi	Sakkottai	Mullangadu	10°07'55"	78°53'01"
504030	Sivagangai	Karaikudi	Sakkottai	Periyakottai	10°07'30"	78°53'33"
504031	Sivagangai	Karaikudi	Sakkotai	Palaiyur	10°06'34"	78°49'28"
504033	Sivagangai	Karaikudi		Amaravathi Pudhur	10°01'20"	78°46'11"
504034	Sivagangai	Karaikudi		Unjanai	10°01'46"	78°49'18"
504035	Sivagangai	Karaikudi		Ariyakudi	10°03'26"	78°47'09"
504036	Sivagangai	Karaikudi		Senjai	10°02'43"	78°45'58"
504037	Sivagangai	Karaikudi		Keeranipatti	10°02'45"	78°42'15"
504038	Sivagangai	Karaikudi		Alangudi	10°02'23"	78°41'33"
504039	Sivagangai	Karaikudi		Marungipatti	10°00'16"	78°40'37"
504040	Sivagangai	Karaikudi		Nadarajapuram	09°55'15"	78°36'40"
504041	Sivagangai	Karaikudi		A.karungkulam	09°53'44"	78°42'11"
504042	Sivagangai	Karaikudi		Aranmanai Siruvayal	09°57'24"	78°39'38"
504043	Sivagangai	Karaikudi		Veppangulam	09°57'09"	78°43'22"
504044	Sivagangai	Manamadurai	Thiruppuvanam	Kilathari	09°54'27"	78°19'59"
504045	Sivagangai	Manamadurai	Thiruppuvanam	Poovanthi	09°51'29"	78°16'16"
504046	Sivagangai	Manamadurai	Thiruppuvanam	Sembur	09°50'49"	78°20'06"
504047	Sivagangai	Manamadurai	Thiruppuvanam	Vembathur	09°48'27"	78°23'11"
504048	Sivagangai	Manamadurai	Thiruppuvanam	Mudikandam	09°52'22"	78°23'37"
504049	Sivagangai	Manamadurai	Thiruppuvanam	Seikalathur	09°43'54"	78°25'58"
504050	Sivagangai	Manamadurai	Thiruppuvanam	Sottathatti	09°51'35"	78°09'58"

504051	Sivagangai	Manamadurai	Thiruppuvanam	Konthagai	09°50'45"	78°11'18"
504052	Sivagangai	Manamadurai	Thiruoouvanam	D.karisalkulam	09°50'51"	78°08'20"
504053	Sivagangai	Manamadurai	Thiruppuvanam	Kraikkilai Vellur	09°47'23"	78°10'01"
504054	Sivagangai	Manamadurai	Thiruppuvanam	Kalukkarkadi	09°50'46"	78°13'26"
504055	Sivagangai	Manamadurai	Thiruppuvanam	Ladanendal	09°48'42"	78°17'41"
504056	Sivagangai	Manamadurai	Thiruppuvanam	Maranadu	09°44'39"	78°20'15"
504057	Sivagangai	Manamadurai		Kattikulam	09°42'37"	78°22'58"
504058	Sivagangai	Sivagangai		Namanur	10°00'08"	78°29'25"
504059	Sivagangai	Sivagangai		Kallarathinipatti	09°59'03"	78°27'12"
504060	Sivagangai	Sivagangai		Edayamelur	09°54'45"	78°26'24"
504061	Sivagangai	Sivagangai		Alagichipatti	09°57'25"	78°26'37"
504062	Sivagangai	Sivagangai		Alagamanagari	10°00'18"	78°28'38"
504063	Sivagangai	Sivagangai		Kattanipatti	10°01'20"	78°28'24"
504064	Sivagangai	Sivagangai		Tavasi Endal Patty	10°01'45"	78°35'50"
504065	Sivagangai	Sivagangai		Keelapoongudi	09°57'37"	78°29'36"
504066	Sivagangai	Sivagangai	Sivagangai	V.malampatti	09°57'03"	78°25'20"
504067	Sivagangai	Sivagangai	Sivagangai	Karungalakudi	09°54'29"	78°30'47"
504068	Sivagangai	Sivagangai	Sivagangai	Kalaiyar Mangalam	09°55'52"	78°32'41"
504069	Sivagangai	Sivagangai	Sivagangai	Sundaranadappu	09°46'57"	78°28'13"
504070	Sivagangai	Sivagangai	Sivagangai	Ponnapatti	09°53'19"	78°32'12"
504071	Sivagangai	Sivagangai	Sivagangai	Perungudi	09°58'01"	78°31'55"
504072	Sivagangai	Sivagangai	Sivagangai	Mathagupatti	09°52'23"	78°32'45"

504073	Sivagangai	Sivagangai	Sivagangai	Udaikulam	09°47'57"	78°32'31"
504074	Sivagangai	Sivagangai	Sivagangai	Kollankudi	09°50'53"	78°35'12"
504075	Sivagangai	Sivagangai		Paganeri	09°57'52"	78°35'24"
504076	Sivagangai	Sivagangai		Pallithambam	09°50'54"	78°41'13"
504077	Sivagangai	Sivagangai	Sivagangai	Andurani	09°47'45"	78°37'52"
504078	Sivagangai	Sivagangai		Marakkathur	09°48'21"	78°41'29"
504079	Sivagangai	Tiruppathur		Thiruppathur	10°06'42"	78°36'07"
504080	Sivagangai	Tiruppathur		Maruthippatti	10°09'44"	78°29'25"
504081	Sivagangai	Tiruppathur		S.v.mangalam	10°10'23"	78°28'08"
504082	Sivagangai	Tiruppathur		Singampunari	10°11'24"	78°25'05"
504083	Sivagangai	Tiruppathur		Praanmalai	10°14'14"	78°45'54"
504084	Sivagangai	Tiruppathur		Naduvayal	10°17'19"	78°28'33"
504085	Sivagangai	Tiruppathur		Mandhakudipatti	10°17'16"	78°30'28"
504086	Sivagangai	Tiruppathur		Thuvar	10°14'16"	78°34'35"
504087	Sivagangai	Tiruppathur		Sevur	10°14'58"	78°36'25"
504088	Sivagangai	Tiruppathur		Elayathakudi	10°12'49"	78°39'02"
504089	Sivagangai	Tiruppathur		Velankudi.s	10°11'48"	78°35'40"
504090	Sivagangai	Tiruppathur		Paiyur	10°09'25"	78°35'11"
504091	Sivagangai	Tiruppathur		Jayankondanilai	10°03'31"	78°26'20"
504092	Sivagangai	Tiruppathur		Ooppilanpatti	10°03'34"	78°29'26"
504093	Sivagangai	Tiruppathur		M.kachapatti	10°04'35"	78°28'56"
504094	Sivagangai	Tiruppathur		Karaiyur	10°07'58"	78°34'24"
504095	Sivagangai	Tiruppathur		Aralikottai	10°01'44"	78°32'37"

504096	Sivagangai	Tiruppathur		Biramanapatti	10°04'35"	78°32'02"
504097	Sivagangai	Tiruppathur		Thikkur.a	10°11'39"	78°31'40"
504098	Sivagangai	Tiruppathur		Mahiblanpatty	10°11'13"	78°34'13"
504099	Sivagangai	Ilanyangudi	Ilayangudi	Puliyankulam	09°42'18"	78°32'16"
504100	Sivagangai	Ilanyangudi	Ilanyangudi	Melaiyur	09°37'13"	78°33'04"
504101	Sivagangai	Devakottai		Puliyal	09°36'05"	78°40'05"
504102	Sivagangai			Sarugani	09°51'00"	78°45'00"
83028	Sivagangai	Manamadurai	Manamadurai	Manalur	09°51'45"	78°13'05"
83028 A	Sivagangai	Manamadurai	Thiruppuvanam	Kalukkarkadi	78°13'26"	09°50'45"
83122	Sivagangai	Sivagangai	Sivagangai	Sivagangai	09°51'00"	78°29'00"
83122 B	Sivagangai	Sivagangai	Sivagangai	Sivagangai Ph	78°28'59"	09°51'10"
83122A	Sivagangai	Sivagangai	Sivaganga	Sivagangai	09°51'00"	78°29'00"
83123B	Sivagangai	Manamadurai	Manamadurai	Manamadurai	09°42'00"	78°27'00"
83124 C	Sivagangai	Manamadurai	Manamadurai	Kattikulam	78°22'58"	09°42'37"
83124B	Sivagangai	Manamadurai	Manamadurai	Rajakambiram	09°43'05"	78°25'10"
83127B	Sivagangai	Sivagangai	Kalayarkoil	Kalayarkoil	09°51'00"	78°38'00"
83129 C	Sivagangai	Ilanyangudi	Ilanyangudi	Thiruvedayarpuram	78°37'03"	09°35'39"
83129B	Sivagangai	Ilaiyangudi	Ilaiyangudi	Ilaiyangudi	09°37'35"	78°37'35"
83137 D	Sivagangai	Devakottai	Devakottai	Udaiyachi	78°48'27"	09°56'44"
83137C	Sivagangai	Devakottai	Devakottai	Devakottai	09°56'45"	78°49'20"
83142A	Sivagangai	Devakottai	Kannangudi	Kannangudi	09°46'25"	78°13'30"
83143 D	Sivagangai	Tiruppathur	Singampuneri	Sakthi Sankaran Kottai	78°30'06"	10°06'32"

83143C	Sivagangai	Thiruppathur	Thiruppathur	Sakthi Sankaran Kottai	10°08'00"	78°30'00"
83144 B	Sivagangai	Tiruppathur		Tiruppathur	78°36'06"	10°06'42"
83144A	Sivagangai	Thiruppathur	Thiruppathur	Thiruppathur	10°07'00"	78°36'00"
83145	Sivagangai	Karaikudi	Sakkottai	Karaikudi	10°06'00"	78°46'00"
83146 B	Sivagangai	Karaikudi	Sakkottai	Sakkottai	78°51'10"	10°05'47"
83146A	Sivagangai	Karaikudi	Sakkottai	Sakottai	10°04'00"	78°51'00"
83147	Sivagangai	Karaikudi	Kallal	Kallal	09°59'00"	78°39'00"
83148	Sivagangai	Sivagangai	Sivagangai	Okkur	09°56'00"	78°31'00"
83150	Sivagangai	Devakottai	Devakottai	Kallankudi	09°54'39"	78°45'52"
83153	Sivagangai	Karaikudi	Sakkottai	Mithiravayal	10°02'45"	78°54'15"
83154	Sivagangai	Karaikudi	Sakkottai	Periakottai	10°07'47"	78°53'35"
83154 A	Sivagangai	Karaikudi	Sakkottai	Periakottai	78°53'33"	10°07'30"
83155A	Sivagangai	Karaikudi	Sakkottai	Mathur	10°04'00"	78°45'02"
83156 B	Sivagangai	Karaikudi	Sakkottai	Kottaiyur	78°47'28"	10°06'57"
83156A	Sivagangai	Karaikudi	Sakkottai	Kottaiyur	10°06'40"	78°47'55"
83157A	Sivagangai	Karaikudi	Kallal	Talakkavur	10°03'45"	78°42'51"
83158	Sivagangai	Karaikudi	Thiruppathur	Nemam	10°08'30"	78°41'30"
83159 B	Sivagangai	Tiruppathur	Tiruppathur	Keelasevalpatti	78°39'37"	10°10'45"
83159A	Sivagangai	Thiruppathur	Thiruppathur	Keelasevalpatti	10°11'12"	78°39'52"
83160 C	Sivagangai	Tiruppathur	Tiruppathur	Pulankurichi	78°35'08"	10°16'14"
83160A	Sivagangai	Thiruppathur	Singampuneri	Pulankurichi	10°16'08"	78°35'30"
83162	Sivagangai	Thiruppathur	Thiruppathur	Kandramanikkam	10°03'08"	78°33'08"
83163	Sivagangai	Karaikudi	Kallal	Sembanur	09°59'50"	78°38'00"

83164A	Sivagangai	Sivagangai	Sivagangai	Madagupatti	09°59'30"	78°32'02"
83165A	Sivagangai	Thiruppathur	Thiruppathur	Thirukkostiyur	10°03'45"	78°33'45"
83166	Sivagangai	Thiruppathur	Singampuneri	Nerkuppai	10°13'00"	78°32'30"
83166 A	Sivagangai	Tiruppathur	Tiruppathur	Nerkuppai	78°31'58"	10°13'40"
83167	Sivagangai	Karaikudi	Kallal	Kallupatti	09°59'30"	78°45'30"
83168 B	Sivagangai	Karaikudi	Sakkottai	Pazghiyur	78°46'45"	10°10'45"
83168A	Sivagangai	Karaikudi	Sakkottai	Kanadukathan	10°10'00"	78°47'00"
83229	Sivagangai	Sivagangai	Sivagangai	Karuvaikudi	09°46'25"	78°13'13"
83229 E	Sivagangai	Manamadurai	Thiruppuvanam	Thiruppuvanam	78°14'57"	09°49'15"
83229D	Sivagangai	Sivagangai	Sivagangai	Karuvaikudi	09°46'25"	78°13'13"
83230	Sivagangai	Sivagangai	Sivagangai	Velacheri	09°45'48"	78°15'21"
83230 A	Sivagangai	Manamadurai	Thiruppuvanam	D.karisalkulam	78°15'19"	09°45'56"
83231	Sivagangai	Manamadurai	Thiruppuvanam	Kondagai	09°50'32"	78°11'15"
83231 A	Sivagangai	Manamadurai	Thiruppuvanam	Konthagai	78°11'17"	09°50'44"
83232	Sivagangai	Manamadurai	Thiruppuvanam	Kilathari	09°58'05"	78°20'00"
83232 B	Sivagangai	Sivagangai	Thiruppuvanam	Kilathari	78°19'59"	09°54'27"
83233	Sivagangai	Sivagangai	Sivagangai	Thirumanjolai	09°51'09"	78°19'50"
83233 B	Sivagangai	Sivagangai	Sivagangai	Thirumanjolai	78°19'53"	09°51'11"
83236	Sivagangai	Sivagangai	Sivagangai	Nallakulam	09°51'35"	78°23'14"
83237	Sivagangai	Sivagangai	Sivagangai	Tamarakki	09°55'00"	78°23'09"
83237 B	Sivagangai	Sivagangai	Sivagangai	Thamarakki	78°22'35"	09°54'51"
83239A	Sivagangai	Sivagangai	Sivagangai	Pudupatti	09°53'45"	78°27'40"
83240	Sivagangai	Sivagangai	Sivagangai	Manakkulam	09°47'13"	78°09'25"

83241	Sivagangai	Sivagangai	Kalayarkoil	Tachanendal	09°42'49"	78°33'32"
83242	Sivagangai	Sivagangai	Kalayarkoil	Satharasan Kottai	09°45'37"	78°32'28"
83243	Sivagangai	Sivagangai	Sivagangai	Nattarasan Kottai	09°52'02"	78°33'09"
83244	Sivagangai	Sivagangai	Sivagangai	Maravamangalam	09°45'48"	78°38'25"
83245	Sivagangai	Sivagangai	Kalayarkoil	Natesapuram	09°50'37"	78°41'37"
83245 A	Sivagangai	Sivagangai	Kalaiyarkoil	Pallithambam	78°41'12"	09°50'53"
83246	Sivagangai	Karaikudi	Kallal	Sathanendalpat ti	09°54'55"	78°38'14"
83247A	Sivagangai	Thiruppathur	Thiruppathur	S.Kovilpatti	10°08'19"	78°28'51"
83248	Sivagangai	Thiruppathur	Thiruppathur	Kottavengampatti	10°08'19"	78°24'39"
83248 B	Sivagangai	Tiruppathur	Singampuneri	Kumaripatti	78°25'39"	10°08'47"
83249A	Sivagangai	Thiruppathur	Thiruppathur	Kirungakottai	10°13'25"	78°25'15"
83250	Sivagangai	Thiruppathur	Singampuneri	Nagamangalam	10°16'57"	78°23'11"
83250 B	Sivagangai	Tiruppathur	S.pudhur	Nagamangalam	78°23'17"	10°17'03"
83251	Sivagangai	Thiruppathur	Singampuneri	Kariyampatti	10°20'58"	78°23'51"
83251 B	Sivagangai	Tiruppathur	S.pudhur	Adikaram	78°24'29"	10°20'33"
83252	Sivagangai	Thiruppathur	Singampuneri	Kanappatti	10°23'41"	78°27'13"
83252 A	Sivagangai	Tiruppathur	S.pudhur	Kanappatti	78°26'51"	10°23'42"
83253	Sivagangai	Thiruppathur	Singampuneri	Varappur	10°20'48"	78°28'35"
83254	Sivagangai	Thiruppathur	Singampuneri	Ulagampatti	10°19'12"	78°30'27"
83255	Sivagangai	Thiruppathur	Singampuneri	Kattukkudippatti	10°17'39"	78°27'34"
83257	Sivagangai	Thiruppathur	Thiruppathur	Manakkudi	10°08'00"	78°33'00"
83258	Sivagangai	Karaikudi	Kallal	Vettiyur	09°54'44"	78°40'27"
83259	Sivagangai	Devakottai	Devakottai	Shanmughanathapuram	09°59'39"	78°48'56"



83260A	Sivagangai	Devakottai	Devakottai	Putturani	09°57'45"	78°53'50"
83261	Sivagangai	Devakottai	Kannangudi	Manakudi	09°46'10"	78°00'15"
83262	Sivagangai	Devakottai	Kannangudi	Visumbur	09°54'02"	78°56'46"
83263A	Sivagangai	Devakottai	Kannangudi	Puliyal	09°50'42"	78°51'57"
83268A	Sivagangai	Ilaiyangudi	Ilaiyangudi	Alavadangan	09°40'00"	78°47'00"
83269	Sivagangai	Ilaiyangudi	Ilaiyangudi	Suranam	09°41'20"	78°43'30"
83270	Sivagangai	Ilaiyangudi	Ilaiyangudi	Sanarendal	09°41'15"	78°38'25"
83270 B	Sivagangai	Ilaiyangudi	Ilaiyangudi	Sanarendal	78°38'04"	09°41'30"
83275	Sivagangai	Ilaiyangudi	Ilaiyangudi	Salaigramam	09°35'45"	78°43'00"
83306	Sivagangai	Karaikudi	Kallal	Sengarai	10°06'37"	78°55'48"

**Sivagangai District - Piezometers - Location and Co-ordinates**

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
179527 AWLR	Sivagangai	Devakottai	Devakottai	Devakottai	10.075000	78.794444
179541 AWLR	Sivagangai	Karaikudi	Sakottai	Karaikudi	9.9500000	78.811944
24001D	Sivagangai	Tiruppathur	Tiruppathur	Keelsevalpatti	10.186667	78.664444
24002D	Sivagangai	Tirupattur	Tirupattur	Poolankurichi	10.268889	78.591667
24003D	Sivagangai	Tirupattur	Tirupattur	Nedumaram	10.141667	78.633333
24004D	Sivagangai	Tirupattur	Singampuneri	S. koilpatti	10.138611	78.480833
24005D	Sivagangai	Sivagangai	Sivagangai	Alavilampatti	9.4666670	78.652778
24006D	Sivagangai	Tirupathur	Singampuneri	Kottaivengampatti	10.137222	78.410833
24007A	Sivagangai	Karaikudi	Sakkottai	Nemathampatti	10.225000	78.763889
24008D	Sivagangai	Tirupathur	Tirupathur	Nerkuppai	10.216667	78.541667
24009A	Sivagangai	Tirupathur	Tirupathur	K. Dharmapatti	10.347222	78.397500
24010A	Sivagangai	Sivagangai	Sivagangai	Thirumanjolai	9.8525000	78.330556
24011A	Sivagangai	Sivagangai	Sivagangai	Tamarakki	9.9166670	78.385833
24012	Sivagangai	Karaikudi	Kallal	Pudukudi	10.005556	78.638889
24013	Sivagangai	Sivagangai	Sivagangai	Alavakottai	9.9916670	78.541667
24014	Sivagangai	Tirupathur	S.pudur	Varappur	10.350000	78.475000
24015	Sivagangai	Karaikuddi	Sakottai	Karaikudi	10.083333	78.766667
24016	Sivagangai	Karaikudi	Kallal	Vetriyur	9.9083330	78.680556

24017	Sivagangai	Sivagangai	Kalayarkoil	Kalayarkoil	9.8500000	78.550000
24018	Sivagangai	Sivagangai	Sivagangai	Nattarasankottai	9.8638890	78.552778
24019	Sivagangai	Ilaiyangudi	Ilaiyangudi	Salaigramam	9.5930560	78.716667
24020	Sivagangai	Karaikudi	Kallal	Visalayankottai	9.9750000	78.736111
24021	Sivagangai	Karaikudi	Sakkottai	Sengarai	10.113889	78.929167
24022	Sivagangai	Devakottai	Devakottai	Kulamangalam	9.7777780	78.741667
24023	Sivagangai	Karaikudi	Sakkottai	Jeyamkondon	10.076389	78.918056
24024	Sivagangai	Karaikudi	Sakkottai	Mithravayal	10.041667	78.908333
24031	Sivagangai	Tiruppathur	Tirupathur	Nachiyapuram	10.085278	78.671389
24032	Sivagangai	Karaikudi	Kallal	Kundrakudi	10.100833	78.708333
24033	Sivagangai	Karaikudi	Kallal	Koothalur	10.035833	78.709167
24034	Sivagangai	Karaikudi	Kallal	Keelapoongudi	9.9466670	78.683333
24035	Sivagangai	Devakottai	Devakottai	Kandadevi	9.9736110	78.824444
24036	Sivagangai	Karaikudi	Sakkottai	Kalanivasal	10.091111	78.749444
24037	Sivagangai	Karaikudi	Sakkottai	Kalanivasal	10.083056	78.739444
24038	Sivagangai	Karaikudi	Sakkottai	Illupakudi	10.041667	78.791667
26025 EX	Sivagangai	Tiruppathur	S.pudur	Ganapathipatti	10.287500	78.403333
26026 EX	Sivagangai	Tiruppathur	S.pudur	Kunnathur	10.301944	78.420556
26027 EX	Sivagangai	Tiruppathur	S.pudur	Kulathupatti	10.378611	78.492222
26028 EX	Sivagangai	Tiruppathur	S.pudur	Karisalpatti	10.353611	78.446667
26029 EX	Sivagangai	Tiruppathur	S.pudur	Khanapatti	10.396111	78.451111
26030 EX	Sivagangai	Tiruppathur	S.pudur	S.pudur	10.319444	78.474722
82136 AWLR	Sivagangai	Manamadurai	Manamadurai	Thirupuvanam	9.8225000	78.258889
82138 AWLR	Sivagangai	Manamadurai	Manamadurai	Anniyendal	9.7538890	78.382222

**(iv) Data Constraints:**

The following are constraints in collecting the water level data in the field and validating the data are:

- 1) The water level data are collected on the monthly basis in the referred observation wells and piezometers. The collected data is not sufficient quantity for analyzing purpose due to drying of wells, Wells abounded by various reasons, lack of selecting the alternate wells, lack of open wells available for monitoring purpose due to increased usage of bore wells in the villages, Panchayats, etc. In many villages, the water supply schemes implemented by overhead tank supply or mini energised pumps and the existing open wells are not used generally by the villagers and moreover, they filled with garbage.
- 2) The number of bore wells should be increased for monitoring purpose.

- 3) The site selection of new bore wells should be based on the Geological methods.
  - 4) Strengthening the network of monitoring wells by closing the gaps in the network.
  - 5) Maintenance cost should be allotted to maintain the bore wells on the periodical basis to maintain the quality as well as yield.
  - 6) Installation of Automatic water level recorders in the sensitive and more water level fluctuation in the bore wells will helpful to monitor the extensive depletion of groundwater areas.
  - 7) Upgrading the measuring instruments will helpful to take accurate reading of water levels in the field.
  - 8) Upgrading the soft ware will helpful to minimize the errors and increasing the accuracy of data.
  - 9) Erecting the Telemetric water level recorders in the over exploited Firkas will helpful to monitor the over extraction of groundwater.
- 10) Lack of manpower and transporting vehicles are also major problems for data collection in the field in proper time.

### **3. DYNAMIC GROUND WATER RESOURCES:**

The State Ground and Surface Water Resources Data Centre has estimated the ground water resources of Tamil Nadu periodically in co-ordination with the Central Ground Water Board, Government of India , Ministry of Water Resources, Chennai, based on the Methodology evolved by the Ground Water Resources Estimation Committee, 1997 (GEC 97).

Groundwater potential assessment is a dynamic one and not static. While assessing an area, the following factors can be considered such as Geology, Total Irrigated Area, Total Number of Wells used for Irrigation, Water Level Data for the past five years, Average Rainfall, Total Recharge, Irrigation methods adopted in the area, Cropping pattern details, Seepage factor, Specific yield, Geological conditions prevailing in that area, Recharge through Artificial recharge structures, etc.

Groundwater potential assessment proposal should be presented for approval in the Central and State Level Working Group Committees and then, presented for final approval in the Central Level Committee as well as State Level Committees.

**The Ground Water Potential Assessments as on January 1992 and January 1997** were done in the State, taking the Panchayat Union Block as an Assessment Unit and the entire State **was categorized as Dark, Grey and White areas**. The Blocks with more than 85% to 100% ground water development (extraction) were categorized as “Dark Blocks” and the blocks with ground water development between 65% to 85% were categorized as “Grey Blocks” and blocks with less than 65% ground water development were categorized as “White Blocks”.

Subsequently, the **Ground Water Potential Assessment was done as on March 2003 and as on March 2009**. In these assessments, the Panchayat Union Blocks in Tamil Nadu were **categorized as Over-Exploited, Critical, Semi-Critical, Safe and Saline instead of Dark, Grey and White blocks**. The Blocks with more than 100% extraction were categorized as “Over Exploited Blocks”, the blocks with 90% to 100% extraction as “Critical Blocks”, the blocks with 65% to 90% extraction as “Semi Critical Blocks”, the blocks with less than 65% extraction as “Safe Blocks” and the bad quality blocks were categorized as “Saline Blocks”. No schemes should be formulated in over exploited and critical blocks - “Notified Blocks – A category – (Stage of Groundwater extraction is 90% and above)”.

The re-estimation of groundwater resources in the State as on March 2011 and as on March 2013 can be assessed in Micro Level basis. In these assessments, the assessing unit is Firka ( Unit of Taluk) and **categorized as Over-Exploited, Critical, Semi-Critical, Safe, and Saline Firkas**. As on March 2013 assessment, in the Villupuram District

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2013, Out of 1139 Firkas in the State, 358 Firkas are categorized as “Over Exploited Firkas”, 105 Firkas are categorized as “Critical Firkas”, 212 Firkas are categorized as “Semi Critical Firkas”, 429 Firkas are categorized as “Safe Firkas” and 35 Firkas are categorized as “Saline Firkas”.

When compared to last assessment as on March 2011, the “Over Exploited Firkas” comes down from 374 to 358 Firkas, the “Critical Firkas” increased from 48 to 105 Firkas, the “Semi Critical Firkas” comes down marginally from 235 to 212 Firkas, the “Safe Firkas” comes down marginally from 437 to 429 Firkas and the “Saline Firkas” remains same as 35 Firkas. The alteration of Firkas are due to the construction

of Artificial Recharge structures such as Check Dams, Recharge Wells, Recharge shafts, percolation ponds; etc was constructed in the “Over Exploited Firkas” by various departments.

#### **Methodology adopted for Estimation of Ground Water Potential :**

The present methodology used for resources assessment is known as Ground Water Resource Estimation Methodology - 1997 (GEC'97) .In GEC'97, two approaches are recommended - **water level fluctuation method and norms of rainfall infiltration method**. The water level fluctuation method is based on the concept of storage change due to differences between various input and output components. Input refers to recharge from rainfall and other sources and subsurface inflow into the unit of assessment. Output refers to ground water draft, ground water evapotranspiration, base flow to streams and subsurface outflow from the unit. Since the data on subsurface inflow / outflow are not readily available, it is advantageous to adopt the unit for ground water assessment as basin / sub basin / watershed, as the inflow / outflow across these boundaries may be taken as negligible.

In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. Further, areas where the quality of ground water is beyond the usable limits should be identified and handled separately. The remaining area after deleting the hilly area and separating the area with poor ground water quality is to be delineated into command and non-command areas. Ground water assessment in command and non-command areas are done separately for monsoon and non-monsoon seasons.

The rainfall recharge during monsoon season computed by Water Level Fluctuation (WLF) method is compared with recharge figures from Rainfall Infiltration Factor (RIF) method. In case the difference between the two sets of data are more than 20% then RIF figure is considered, otherwise monsoon recharge from WLF is adopted. While adopting the rainfall recharge figures, weight age is to be given to WLF method over adhoc norms method of RIF. Hence, wherever the difference between RIF & WLF is more than 20%, data have to be scrutinized and corrected accordingly.

During non-Monsoon season, rainfall recharge is computed by using Rainfall infiltration Factor (RIF) method. Recharge from other sources is then added to get total non-Monsoon recharge. In case of areas receiving less than 10% of the annual rainfall during non-monsoon season, the rainfall recharge is ignored.

The total annual ground water recharge of the area is the sum-total of monsoon and non-monsoon recharge. An allowance is kept for natural discharge in the non-monsoon season by deducting 5 to 10 % of total annual ground water recharge.

The balance ground water available accounts for existing ground water withdrawal for various uses and potential for future development. This quantity is termed as Net Ground Water Availability.

Net Ground Water Availability = Annual Ground Water Recharge - Natural discharge during non-monsoon season.

GEC'97 methodology has recommended norms for various parameters being used in ground water recharge estimation. These norms vary depending upon water bearing formations and agroclimatic conditions. While norms for specific yield and recharge from rainfall values are to be adopted within the guidelines of GEC'97, in case of other parameters like seepage from canals, return flow from irrigation, recharge from tanks & ponds, water conservation structures, results of specific case studies may replace the adhoc norms.

The Gross yearly ground water draft is to be calculated for Irrigation, Domestic and Industrial uses. The gross ground water draft would include the ground water extraction from all existing ground water structures during monsoon as well as during non-monsoon period. While the number of ground water structures should preferably be based on latest well census, the average unit draft from different types of structures should be based on specific studies or adhoc norms given in GEC'97 report.

The stage of Ground water Development is defined by

$$\text{Stage of Ground water Development (\%)} = \frac{\text{Existing Gross Ground water Draft for all uses}}{\text{Net annual Ground Water Availability}} \times 100$$

The units of assessment are categorized for ground water development based on two criteria – a) stage of ground water development and b) long-term trend of pre and post monsoon water levels. Four categories are - Safe areas which have ground water potential for development; Semi-critical areas where cautious ground water development

is recommended; Critical areas; Over -exploited areas where there should be intensive monitoring and evaluation and future ground water development be linked with water conservation measures.

The criteria for categorization of assessment units are as follows:

S. No.	Stage of Groundwater Development	Significant Long term Decline		Categorization
		Pre-monsoon	Post -monsoon	
1.	<=70%	No	No	SAFE
		Yes / No	No / Yes	To be re-assessed
		Yes	Yes	To be re-assessed
2.	>70% and <=90%	No	No	To be re-assessed
		Yes / No	No / Yes	SEMI – CRITICAL
		Yes	Yes	SEMI – CRITICAL
3.	>90 and <=100%	No	No	To be re-assessed
		Yes / No	No / Yes	CRITICAL
		Yes	Yes	CRITICAL
4.	>100%	No	No	To be re-assessed
		Yes / No	No / Yes	OVER- EXPLOITED
		Yes	Yes	OVER- EXPLOITED

Note: 'To be re-assessed' means that data is to be checked and reviewed. If the ground water resources assessment and the trend of long term water levels contradict each other. This anomalous situations requires a review of the ground water resource computations, as well as the reliability of water level data.

The long term ground water level data should preferably be for a period of 10 years. The significant water level decline may be taken in consideration between 10 to 20 cm/ year depending upon the local hydro geological conditions.

**Dynamic Ground Water Resources Estimation of TamilNadu As on March 2013**

**District Summary**

( in ha.m )

<b>SIVAGANGAI DISTRICT</b>							
SI.No ( District))	District	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 (4+5)	Stage of Ground Water Development $\{(6/3)*100\}$ %	No of Over Exploited Firkas
1	2	3	4	5	6	7	8
1	SIVAGANGAI	1,496.90	0.00	2,768.26	2,768.26	185	NIL

**Firka Wise Summary**

(in ha.m)

<b>SIVAGANGAI DISTRICT</b>							
SI.No	Assessment Unit (Firka)	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 (4+5)	Stage of Ground Water Development $\{(6/3)*100\}$ %	Category of the Firka
1	A.THIRUVUDUIR PURAM	1,255.60	176.38	32.20	208.58	17	SAFE
2	DEVAKOTTAI	2,741.21	334.00	39.22	373.22	14	SAFE
3	ILAYANGUDI	1,246.74	150.24	22.96	173.20	14	SAFE
4	ILAYATHAKUDI	2,366.78	300.98	19.81	320.79	14	SAFE
5	KALAYARKOVIL	2,717.03	893.20	49.48	942.68	35	SAFE
6	KALLAL	2,907.67	282.83	40.29	323.12	11	SAFE
7	KANDADEVI	2,847.35	279.81	34.01	313.82	11	SAFE



**SIVAGANGAI DISTRICT**

<b>SI.N o</b>	<b>Assessment Unit (Firka)</b>	<b>Net Annual Ground Water Availabilit y</b>	<b>Existing Gross Ground Water Draft for Irrigation</b>	<b>Existing Gross Ground Water Draft for domestic and industrial water supply</b>	<b>Existing Gross Ground Water Draft for All uses (4+5)</b>	<b>Stage of Ground Water Developm ent {(6/3)*100} %</b>	<b>Category of the Firka</b>
8	KANNANGUDI	2,933.96	32.48	21.14	53.62	2	SAFE
9	KARAIKUDI	1,791.00	198.08	58.41	256.49	14	SAFE
10	KONTHAGAI	2,069.48	640.69	44.34	685.03	33	SAFE
11	MALLAL	3,011.36	623.65	29.33	652.98	22	SAFE
12	MANAMADURAI	2,890.47	292.08	40.10	332.18	11	SAFE
13	MARAVAMANGALA M	4,933.44	906.00	40.39	946.39	19	SAFE
14	MATHAGUPATTI	2,063.99	776.80	36.41	813.21	39	SAFE
15	MITHRAVAYAL	3,052.08	152.00	19.55	171.55	6	SAFE
16	MUTHANENTHAL	2,716.96	383.48	37.44	420.92	15	SAFE
17	NATCHIYAPURAM	1,995.24	115.28	15.32	130.60	7	SAFE
18	NATTARASANKOT TAI	3,167.22	1,081.25	27.96	1,109.21	35	SAFE
19	NERKUPPAI	2,094.89	264.20	26.10	290.30	14	SAFE
20	OKKUR	2,285.06	721.62	54.53	776.15	34	SAFE
21	PALLATHUR	1,614.47	179.18	27.35	206.53	13	SAFE
22	PERIAKOTTAI	2,874.19	409.82	46.61	456.43	16	SAFE
23	PUZHIAL	2,357.23	212.67	29.08	241.74	10	SAFE
24	S.S.KOTTAI	1,814.24	883.86	34.36	918.22	51	SAFE
25	SAKKOTTAI	2,051.00	387.67	42.50	430.17	21	SAFE
26	SALAIGRAMAM	1,377.30	170.99	32.61	203.60	15	SAFE
27	SARUGANI	4,079.55	227.33	40.52	267.85	7	SAFE
28	SEIKALATHUR	2,612.31	274.74	66.95	341.69	13	SAFE
29	SINGAMPUNARI	2,223.23	531.91	52.47	584.37	26	SAFE
30	SIVAGANGAI	2,394.45	528.17	43.00	571.17	24	SAFE
31	SOORANAM	1,392.58	331.90	30.60	362.50	26	SAFE
32	THAMARAKKI	2,005.72	552.88	35.35	588.23	29	SAFE

33	THAYAMANGALAM	2,120.55	110.84	23.78	134.62	6	SAFE
34	THIRUKOSTIYUR	1,307.48	349.16	23.71	372.87	29	SAFE
35	THIRUPPACHETHY	2,875.94	981.02	51.09	1,032.10	36	SAFE
36	THIRUPPATHUR	1,719.82	423.40	28.61	452.01	26	SAFE
37	THIRUPPUVANAM	2,399.92	690.34	40.70	731.04	30	SAFE
38	VARAPPUR	2,311.14	1,920.35	63.05	1,983.40	86	SEMI CRITICAL
<b>TOTAL</b>		<b>90,618.63</b>	<b>17,771.25</b>	<b>1,401.34</b>	<b>19,172.59</b>	<b>21</b>	

#### 4. Groundwater quality issues:

The rainfall is the main source for the availability of water both in surface and sub surface. The quantum of rainfall varies every year depending upon the monsoon. However, the extraction of surface and sub surface water is increasing year by year. It leads to environmental impact on the water sources like depletion of water level, deterioration of water quality. It makes the demand for the quantification of available water and also its quality for various purposes like agriculture, industries, drinking and domestic purposes.

For the present assessment, the value of Total Dissolved Solids (TDS) have been considered for demarcation of good / bad quality areas. For this purpose, the TDS value of less than or equal to 2000 mg/l have been considered as good quality and the value more than 2000 mg/l have been considered as bad quality areas.

The presence of fluoride in natural Ground Water is having its merits and demerits depending upon the concentration. Presence of fluoride <1.0 mg/l in drinking water reduces dental diseases whereas higher level > 1.50 mg/l will affect the health and causes dental fluoridise. Nitrate is noted significantly in Ground Water due to use of chemical fertilizer for agriculture and other local pollution rocks and soils are also contributing nitrate to Ground Water. Arsenic is another poisonous heavy metal in Ground Water. The allowable limits for drinking purposes are 0.05 mg/l.

In Sivagangai District, the quality of Ground Water generally ranges from moderate to good quality both in the shallow dug well and bore wells except in & around the Kazhuveli tank, where the water quality is poor due to seawater intrusion in the lagoons during high tide seasons, the production of salt and Aquaculture farming.

## 5. Groundwater issues and challenges:

The groundwater quantity and quality are to be highlighted and may be analyzed in terms of :

### (i) Problems posed by nature:

In terms of Quantitative aspects, nowadays, rainfall may more within the short period of duration. Due to this aspect, recharge is less and runoff will be more. The availability of groundwater is less due to over extraction than recharge. The Percentage of OE/Critical Firkas increased due to this reason. Increasing the artificial recharge structures in the proper areas may avoid the depletion of groundwater especially in OE/Critical Firkas.

### (ii) Problems caused by anthropogenic activities:

The problems caused due to intensive groundwater extraction, intensive surface water irrigation, intensive mining activities, growing urban complexes and industrial establishments will lead to drastic depletion in groundwater resources only. Proper alternative recharge structures must be established.

### (iii) Problems caused by socio-economic condition:

The land holdings of farmers may be different from another. One farmer having more than 5 Acres has less expense than a farmer having one acre. The free electric supply to all farmers have chance to extract more groundwater. To avoid this, proper guidance will be given to the farmers for the usage of groundwater.

### (iv) Administrative issues:

To control, regulate and manage the Ground Water Resources in the State, there is no groundwater act, now in force. But, the **Chennai Metropolitan Area Ground Water (Regulation) Act, 1987** is in force and it extends to Chennai City and notified 302 revenue villages in Kanchipuram and Thiruvallur Districts, only.

The rest of Tamilnadu, **G.O.(Ms).No.142, Public Works (R2) Department, dated: 23.07.2014** and **G.O.(Ms).No.113, Public Works (R2) Dept , Dt:09.06.2016** are regulate and manage the groundwater resources. The Government of Tamil Nadu had enacted the **Tamil Nadu Ground Water (Development and Management) Act, 2003**. However, this **Act was repealed on 14.09.2013**, in order to enact a comprehensive law to develop and manage the groundwater in the changed scenario in the State.

The pricing policy for groundwater users is also an important strategy in controlling the illegal extraction of groundwater by taking from lorries,etc. The

unused dug wells and bore wells can be used as artificial recharge structures will be good concept in recharging the ground water.

## **6. Groundwater Management and Regulations:**

### **(i) Statute/Law/Policy/Regulations if any:**

The Central Ground Water Authority has been constituted to regulate, control, development and management of ground water resources for whole country based on overall situation prevailing in India. But, the ground water conditions are varying from State to State. **Ground Water is a State subject and the State Government has every right to protect and regulate their own precious ground water resources according to the prevailing conditions in the State.**

The Tamil Nadu Government had enacted “**The Tamil Nadu Ground Water (Development and Management) Act, 2003**” which was subsequently **repealed in 2013**, so as to bring out an effective management Act considering the present scenario. **As an interim measure, for regulating the exploitation of ground water, the Government have issued G.O. (Ms) No.142,PWD dated 23.07.2014 for regulations for management of ground water for safe guarding the scarce groundwater resources in Tamil Nadu State.** In the absence of an Act, the Government executes this Government order to control, regulate and manage the Ground Water Resources while taking into consideration of the future of the State and its people.

**The State Ground and Surface Water Resources Data Centre has estimated the Ground Water resources of Tamil Nadu State periodically** in co-ordination with the Central Ground Water Board, Government of India, SECR, Chennai, based on the Methodology evolved by Ground Water Resources Estimation Committee, 1997 (GEC 97).

Accordingly, **the Ground Water Potential Assessment done as on January 1992 and as on January 1997 on the basis of Panchayat Union Blocks as assessment units** in Tamil Nadu and **categorized as Dark, Grey and White areas.** The Blocks with more than 85% to 100% ground water development were categorized as “Dark Blocks” and the blocks with ground water development

between 65% to 85% were categorized as “Grey Blocks” and less than 65% ground water development were categorized as “White Blocks” and the Government approved the categorisation and released as Government order and G.O.No:326, PW (R2) Dept, dated: 23.11.1993. It was in effect up to the next assessment done as on March 2003.

Subsequently, **the Ground Water Potential Assessment done as on March 2003, categorized the blocks as Over Exploited, Critical, Semi Critical, Safe, Saline instead of Dark, Grey and White blocks.** The Blocks with more than 100% were categorized as “Over Exploited Blocks”, the blocks in between 90% to 100% as “Critical Blocks”, the blocks in between 65% to 90% as “Semi Critical Blocks” and less than 65% as “Safe Blocks” and the bad quality blocks were categorized as “Saline Blocks” and the same was approved by the Government and released as G.O.No:51, PW (R2) Dept, dated: 11.02.2004. It was in effect up to the next assessment done as on March 2009.

The Next **Ground Water Potential Assessment done as on March 2009**, and the same was approved by the Government and **released as G.O.No:52,PW(R2) Dept, dated: 02.03.2012.**

As per G.O.No.52,PW(R2) Dept, dated: 02.03.2012 and G.O. (Ms) No.142,PW(R2)Dept dated 23.07.2014, the State Government have authorized and empowered the Chief Engineer, State Ground and Surface Water Resources Data Centre, Chennai for issuing permission or license or No Objection Certificate/renewal for drawal and transportation of Ground Water based on the hydro geological conditions to the New Industries, Packaged Drinking Water Companies, Infrastructures and Mining projects, etc except the areas to which the Chennai Metropolitan Area Ground Water (Regulation) Act,1987 extends.

Subsequently, the next **Ground Water Resources Assessment of the State was completed as on March 2011** and taking **Firka as an assessment unit** in the State of Tamil Nadu. Based on the above assessment, **the Government had approved and issued G.O.(Ms).No.113, Public Works (R2) Dept , Dt:09.06.2016** for categorisation of the Firkas in the State as Over Exploited, Critical, Semi-Critical and Safe Firkas. All the Over Exploited and Critical Firkas are notified as **“A” Category** (where the stage of ground water extraction is 90% and Above) and all

the Semi Critical and Safe Firkas are notified as **“B” Category** (where the stage of ground water extraction is below 89%). In this Government Order, the Government had directed that **no Schemes should be formulated in the “A” Category Firkas and in “B” Category Firkas, all the Schemes should be formulated through State Ground and Surface Water Resources Data Centre by issuing No Objection Certificate for Ground Water Clearance.**

The term “Schemes” excludes Energisation of Agricultural pump sets by the Tamil Nadu Electricity Board. The present order may also exclude the Ground Water drawal for a). Domestic purpose by individual household, b). Domestic Infrastructure project (Housing), c).Government’s Drinking Water Supply Schemes and d). non water based industries, (i.e.- the industries which do not require and use water, either as raw material or for other processing). However, the domestic use of water by this non water based industries will be permitted by the Chief Engineer / State Ground and Surface Water Resources Data Centre based on hydro geological conditions. (i.e. NOC from Chief Engineer, State Ground and Surface Water Resources Data Centre, Water Resources Department, Chennai). The list of non water based industries will be issued by the Industries Department of Government of Tamil Nadu separately.

Appropriate rain water harvesting and Artificial recharge schemes should be carried out in the categories viz , Over exploited , Critical , Semi Critical and Safe blocks of Tamil Nadu. While carrying out the above schemes, priority should be given to marginal quality and bad quality areas so as to avoid further deterioration.

All the schemes and proposals based on Ground Water will have to adhere to the Government orders and conditions. The Chief Engineer, State Ground and Surface Water Resources Data Centre had received the Government approval on Groundwater Assessment as on March 2011.

Regarding granting permission/ License for transportation of ground water for water suppliers/ private water tankers for selling the water on commercial basis, the State Ground and Surface Water Resources Data Centre, Public Works Department is not issuing any No Objection Certificate.

The Chief Engineer, SG&SWRDC have empowered to issue the NOC for drawal of Ground Water is up to 1 Million Gallons per day. Beyond this, the

firms should get an approval in Water Utilisation Committee for drawal of both Surface and Ground Water resources in Tamil Nadu.

**(ii) Suggestions for improvement of groundwater governance.**

Groundwater is recognized as a common pool resource. The use of groundwater by anybody should in no way cause adverse impacts on realization of other person's fundamental right to safe water for life. Access to groundwater without any discrimination, equitable distribution, and sustainable use considering the needs of future generations are considered. Right to water for life is the first priority and then to agriculture, and eco system needs. The precautionary principle and the polluter pay principle only to conserve and recharge groundwater.

The responsibility of the State for ensuring every person's right to safe water even when water service is delegated to a private agency. Groundwater is not amenable to ownership by the State, communities or persons and the State is the public trustee of groundwater. It also deals elaborately on groundwater protection and groundwater security plans.

The Groundwater Act should incorporate legal pronouncement on groundwater such as the public, trust doctrine and recognition of the right to groundwater. It addresses the deficiencies in the present legal frame work in dealing with over exploitation and includes the improvements to the control mechanism to ensure the qualitative and quantitative sustainability of groundwater resources. It proposes to strengthen the regulating powers of Panchayat and Municipal bodies related to Ground water in line with articles 243G and 243W of the constitution.

The Pricing of Ground Water for irrigation, Industrial and domestic purposes and collecting fees by water users association should be left to the State decision.

**(iii) Institutions governing/managing/monitoring the resources and Institutional structure, gaps if any :**

While framing the Groundwater Act, the recommendation for the constitution of (1) Gram Panchayat Groundwater Sub-Committee, (2) Block Panchayat Groundwater Management, (3) Ward Groundwater Committee, (4)

Municipal Water Management Committee, (5) District Ground Water Council and (6) State Ground Water Advisory Council to control and manage Ground water should be considered.

- The constitution of aforesaid committees is completely based on administrative boundaries such as village, block, ward, municipality, district etc. But, with respect to water resources control and management issues and conflicts, the boundary should be based on river basins to have efficient monitoring and management of water resources. The Government of India, in all issues related to water resources considered only the basin boundary concept. Hence, the institutional frame work has to be revised so as to have the jurisdiction of the committees with respect to basin / watershed concept. Further, Government of India, MoWR, RD &GR advocates time and again integrated water resources management. The above institutional frame work separately for groundwater is not in line with that.
- Further, it has also provided for many committees, viz., Gram Panchayat Groundwater Sub-Committee, Village Water and Sanitation Committee, Ward Committee, Municipal Committee, Block level Committee, District level Committee and State level Committee. For managing surface water resource water users association already exists. Too many committees at village / ward level would jeopardize the very purpose of managing the Groundwater resources efficiently and may invite lot of conflicts.

**(iv) Areas of people/private participation if any:**

The participation of people or private parties in the groundwater management is not suggestible, acceptable one and more chances of making litigations in the society and has unnecessary law and order problems may arise.

## **7. Tools and Methods**

**(i) Water Level and quality measurements through wells, piezometers, DWLR with telemetry, ground water elevation.**

In general, water levels in the observation wells and piezometers can be taken manually by measuring tape. This is the simple, cost effective, good accuracy and less maintenance method. Water Levels are observed above the Measuring point.



Monitoring water level in DWLR with telemetry is costly, high maintenance, good accuracy, get the data immediately on desktop, easy to analysis purpose.

The water quality generally is analysed in the Chemical Lab only by collecting water samples in Pre Monsoon and post Monsoon period in the field. Sometimes, instant kits are used for analyzing the TDS and Ph level in the water.

**(ii) Metering water supply to confirm contribution from groundwater.**

Metering the water supply is essential one to monitor the overall usage of groundwater by different sectors. Flow meter must be fixed in every extraction structure and it has to be monitored periodically by Government officials.

**8. Performance Indicators:**

**(i) Bench Marks/ Norms/ Standards and deviation from the norms/bench marks/ standards currently.**

The Ground Water resources of State periodically estimated in co-ordination with the Central Ground Water Board, Government of India, SECR, Chennai, based on the Norms evolved by Ground Water Resources Estimation Committee, 1997 (GEC 97).

The ground water potential assessment can be assessed based on the bench marks such as Average Rainfall, Total recharged Area, Monthly Water Level Data, Total no of wells in the area, Irrigation methods adopted, Cropping pattern details, Geological conditions prevailing in that area, Specific yield, Seepage factor, Constructed Artificial recharge structures, etc and various calculations methods, etc, have to be considered.

**Status of various Performance Indicators**

**(ii) Percentage of over exploited ,critical, Semi critical , Safe and Saline/Poor quality Firkas/area units**

- Trend of over exploited and critical Firkas to total Firkas as per pervious assessment. ( 2009 Assessment Vs 2011 Assessment)

The Ground Water Potential Assessment as on March 2009, Out of 12 blocks in Sivagangai District, 12 blocks are categorized as Safe blocks.

The next Ground Water Resources Assessment of the State was done as on March 2011 and taking Firka as an assessment unit. In Sivagangai

District, totally 38 Firkas, 38 Firkas are categorized as Semi Critical and Safe blocks.

Instead of taking Block as an assessment, Firka can be taken as assessment unit is to concentrate the assessment in micro level. For Eg, a block contains more than three to four Firkas. In this block, two Firkas may have good groundwater potential than other two Firkas but it may to categorize as Over Exploited. To avoid this, assessment done on the basis of Firkas for the benefit of farmers to the implementation of schemes related to Irrigation.

The percentage of over exploited and critical Firkas has been increased by changing the concept from Block to Firka assessment. The total percentage of over exploited and critical Blocks for 2009 Assessment is Nil, but, the total percentage of over exploited and critical Firkas as on March 2011 Assessment is Nil, in the Sivagangai District.

- Trend of over exploited and critical Firkas to total Firkas as per latest assessment  
The percentage of over exploited and critical Firkas has been decreased in 2013 latest assessment when compared to 2011 assessment. In 2011 assessment, out of 38 Firkas, the total percentage of over exploited and critical Firkas is Nil, but, In 2013 assessment, out of 38 Firkas, it has been come down marginally to Nil, in the Sivagangai District.
- Existing state of groundwater resources as compared to previous assessment ( 2013 Vs 2011 assessment).

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2013, Out of 38 Firkas in the District, 1 Firkas are categorized as “Semi Critical Firkas”, 37 Firkas are categorized as “Safe Firkas”.

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 38 Firkas in the District, 1 Firkas are categorized as “Semi Critical Firkas”, 37 Firkas are categorized as “Safe Firkas”.

When compared to last assessment as on March 2011, the “Semi Critical Firkas” maintains the same as 1 Firkas, the “Safe Firkas” maintains the same as 37 Firkas and the “Saline Firkas” remains Nil Firkas. The alteration of Firkas are due to the construction of Artificial Recharge structures such as Check Dams, Recharge Wells, Recharge shafts, percolation ponds; etc was constructed in the “Over Exploited Firkas” by various departments.

S.No	Categorisation	No of Firkas	
		2011	2013
1	Over Exploited	Nil	Nil
2	Critical	Nil	Nil
3	Semi Critical	1	1
4	Safe	37	37
5	Saline	Nil	Nil
TOTAL		38	38

(iii) Water Level(Well hydrographs and water level trends – pre and post monsoon such as declining trend/rising trend,etc).

(iv) Comparison of area irrigated from groundwater resources (Current assessment 2013 to previous assessment 2011).

S.No	Description	2011 Assessment	2013 Assessment
1	Area Irrigated from ground water resources( In hm)	6538.07	6505.06

(v) No. of groundwater abstraction structures (existing no. over the year and trends).

S.No	Description	2011 Assessment	2013 Assessment
1	No of groundwater abstraction structures for Irrigation	1,71,071 Wells	1,70,983 Wells

(vi) Trend in water quality ( no of habitations affected with groundwater contamination like As, F, Salinity etc. Change in contamination level over the years.

(vii) Source augmentation (Groundwater)

- Area covered with infrastructure for recharging groundwater:

The proper artificial recharge structures has to be constructed based on local geological conditions in the areas of existing infrastructure for recharging groundwater according to their extraction needs.

- GW recharge plan to combat adversaries:

Groundwater recharge plans has to be strictly followed by with of implementing the groundwater laws to combat adversaries.

9. Reforms undertaken/being undertaken/proposed if any.

10. Road Map of activities/tasks proposed for better governance with timelines and agencies responsible for each task/activity.