CHAPTER 4.1.9 GROUND WATER RESOURCES

VIRUDHUNAGAR DISTRICT

INDEX

GROUND WATER REPORT OF VIRUDHUNAGAR DISTRICT

INRODUCTION :

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 Virudhunagar district is 4, 24,323 sq.km accounting for 3% of area of Tamil Nadu State. The district has well laid out roads and railway lines connecting all major towns within and outside the state. There are 8 Taluks ,11 Blocks and 36 Firkas vide Table -1 and Map-1.

The Geographic co-ordinates of the district is

Latitude : 9°12’00” - 9°47’ 30” North and

Longitude: 77°20’30”- 78°26’00” East.

Virudhunagar district is totally bifurcated into 36 Firkas.

1. Hydrogelogy

(i) Major Geological formations:

Geology:

Geologically, the entire district can be broadly classified into hard rock and sedimentary formation of alluvium and tertiary.

a) Hard rock:

Limestones associated with gneiss are noticed in 1. Krishnapuram and Koonampatti in Srivilliputhurtaluk 2.Aslapuram and Cholapuram in Rajapalayamtaluk 3.

Palavanatham area in Virudhunagar – Aruppukottai road 4. Around Mullapuram and Virudhunagararea 5. Pandalgudi near Ramalingapuram and South of Reddiyapatti in Aruppukottaitaluk.Charnockiteoccurs in the western part of district around Srivilliputhur. The granite bands of pink colour occur south of Watrap and around Mangalam.

Major part of the district is covered by Gneissic groups of rocks which include granetiferous gneiss, Hornblende gneiss, mica gneiss, pink and gray granitic gneiss.

b) Sedimentary formation:

Eastern part of the district is covered by Alluvial formation of recent age occurring in east of Narikudi block and southeast of Thiruchuli block.

Tertiary formations occupy eastern part of the district covering part of Narikudi, Thiruchuli and the Kariyapatti block.

The area covered by various geological formation of the district is tabulated as follows:

Sl.no.	Formation	Area covered in ha
1.	Hard rock	3,60,675
2.	Alluvium and sedimentary	63,648
	Total	4,24,323

Drilling of boreholes:

The occurrence and movement of groundwater in hard rock formations are restricted to open system of fractures like fissures and joints in unweathered portion and also in the porous zones of weathered formations. Generally, in hard rocks regions, occurrence of weathered layer is discontinuous both in space and depth. Hence the recharge in hard rock formation is influenced by the intensity of weathering. The sub surface conditions can be ascertained by drilling exploratory bore holes and conducting pump tests. The State Ground and Surface Water Resources Data Centre, during the course of investigations, has drilled more than 223 boreholes spread over the entire district to find out the nature and behaviour of the sub surface formations.

There is considerable diversity in the nature of formation even within short distance. There is considerable thickness of valley fill sediments in watrap block area. In rajapalayam and sivilliputhur blocks, the weathered and fracture zone is limited to 25 to 35 m below ground level. In the remaining parts of the district the weathered and fracture zones varies from 20 to 30 m. In the sedimentary area of this district, the thickness of alluvial and tertiary formation ranges from 35 to 40 m.

Aquifer parameters:

a) Hard rock

The thickness of aquifer in this district is highly varying between 15 m to 40 m below ground level. The intergranularporosity essentially depends upon the intensity and degree of weathering and fracture development in the hard rock. Deep weathering is developed in Gneissic formations and moderate weathering in charnockite formations. The range of aquifer parameters in hard rock region is given below.

Parameters	**Range**
Well yield in LPM	40-110 lpm
Transmissivity (T) m^2/day	0.224-0.60 m^2/day
Permeability (K) m/day	0.049-0.147 m/day

b) Valley fill sediments

In Watrap block area the valley fill sediments varies between 25 to 30m below ground level. Recharge is mainly from precipitation and surface runoff during monsoon seasons. The range of aquifer parameter values of valley fill sediments are furnished below.

Parameters	**Range**
Well yield in LPM	40-150 lpm
Transmissivity (T) m^2/day	59.66-74.57 m^2/day
Permeability (K) m/day	3.91-5.87 m/day

c) Tertiary formations

Parameters	Range
Well yield in LPM	200-400lpm
Transmissivity (T) m^2/day	14.91-671.14 m^2/day
Permeability (K) m/day	19.57-83.17 m/day

(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 Bento novate 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 Virudhunagar 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 Virudhunagar District,86 observation wells and 59 piezometers,totally 145 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 Virudhunagar 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 Virudhunagar District. The analysis reveals that the water level has gone down in the north, west and central parts of the Virudhunagar 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 sectored 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 Virudhunagar District.

(iii) Existing network of Monitoring wells:

In Virudhunagar District, the existing network of monitoring wells is

145 wells, 86 wells are observation wells and 59 wells are piezometers. These wells are observed for every month water level.

Virudhunagar District: Observation Wells - Location and Co-ordinates

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
505001	Virudhunagar	Aruppukkottai	Aruppukottai	Koppuchithampatti	09°24'36"	78°09'16"
505002	Virudhunagar	Aruppukkottai	Aruppukottai	Meenatchi Puram	09°29'02"	78°03'27"
505003	Virudhunagar	Aruppukkottai	Aruppukottai	P.andipatti	09°21'52"	78°05'06"
505004	Virudhunagar	Aruppukkottai	Aruppukottai	Periyapuliampatti	09°30'50"	78°05'03"
505005	Virudhunagar	Aruppukkottai	Aruppukottai	Ramasamypuram	09°29'42"	78°05'56"
505006	Virudhunagar	Aruppukkottai	Aruppukottai	Sukkelanatham	09°28'49"	78°04'30"
505007	Virudhunagar	Aruppukkottai	Kariapatti	Allalaperi	09°38'43"	78°13'27"
505008	Virudhunagar	Aruppukkottai	Kariapatti	Johilpatti	09°38'50"	78°06'37"
505009	Virudhunagar	Aruppukkottai	Kariapatti	Mallankinaur		
505010	Virudhunagar	Aruppukkottai	Kariapatti	Manthoppu	09°38'48"	78°02'21"
505011	Virudhunagar			Mustakurichi		
505012	Virudhunagar	Aruppukkottai	Kariapatti	Papanam	09°41'05"	78°08'34"
505013	Virudhunagar	Aruppukkottai	Kariapatti	Thenoor	09°38'43"	78°13'29"
505014	Virudhunagar	Rajapalayam	Rajapalayam	Chokkanathanpudur	09°21'49"	77°27'04"
505015	Virudhunagar	Rajapalayam	Rajapalayam	Choloicheri	09°25'20"	77°30'05"
505016	Virudhunagar	Rajapalayam	Srivilliputhur	Keelaraja Kularaman	09°23'59"	77°37'56"
505017	Virudhunagar	Rajapalayam	Rajapalayam	Muthusamypuram	09°23'36"	77°28'21"
505018	Virudhunagar	Rajapalayam	Rajapalayam	Nallamangalam	09°21'54"	77°29'45"

505019	Virudhunagar	Rajapalayam	Rajapalayam	Thenkarai	09°20'20"	77°36'16"
505020	Virudhunagar	Rajapalayam	Rajapalayam	Varakunarampuram	09°22'27"	77°37'11"
505021	Virudhunagar			Alangulam		
505022	Virudhunagar	Sathur	Sathur	Mettamalai	09°23'43"	77°53'58"
505023	Virudhunagar	Sathur	Sathur	O.mettupatti	09°19'42"	77°53'32"
505024	Virudhunagar	Sathur	Vembakottai	Kangarkottai	09°17'11"	77°49'07"
505025	Virudhunagar	Sivakasi	Sivakasi	Enjar	09°29'24"	77°44'18"
505026	Virudhunagar	Sivakasi	Sivakasi	Erichanatham	09°37'52"	77°49'00"
505027	Virudhunagar	Sivakasi	Sivakasi	Ethirkottai Ayacut	09°22'10"	77°43'29"
505028	Virudhunagar	Sivakasi	Sivakasi	Kil Thiruthangal	09°28'46"	77°49'30"
505029	Virudhunagar	Sivakasi	Sivakasi	Mangalam	09°34'00"	77°44'57"
505030	Virudhunagar	Sivakasi	Sivakasi	Maraneri	09°26'13"	77°44'37"
505031	Virudhunagar	Sivakasi	Sivakasi	Narna Puram	09°27'33"	77°50'50"
505032	Virudhunagar	Sivakasi	Sivakasi	Sevalur	09°37'44"	77°47'08"
505033	Virudhunagar	Sivakasi	Sivakasi	Vadapatti	09°31'28"	77°46'38"
505034	Virudhunagar	Sivakasi	Sivakasi.	Vellore	09°34'05"	77°49'39"
505035	Virudhunagar	Sivakasi	Sivakasi	Visvanatham	09°25'44"	77°48'20"
505036	Virudhunagar	Sivakasi	Sivakasi	Ethirkottai	09°22'58"	77°43'28"
505037	Virudhunagar	Sivakasi	Vembakottai	Keelan Marainadu	09°19'49"	77°42'22"
505038	Virudhunagar	Sivakasi	Vembakottai	Nathikudi	09°25'42"	77°41'28"
505039	Virudhunagar	Srivilliputthur	Srivilliputhur	Achamthavirthan	09°26'06"	77°39'50"

505040	Virudhunagar	Srivilliputthur	Sriviliputhur	Athikulam & Sengulam	09°29'48"	77°39'01"
505041	Virudhunagar	Srivilliputthur	Watrap	Govindanallur	09°40'20"	77°45'35"
505042	Virudhunagar	Srivilliputthur	Watrap	Ilanthaikulam	09°39'43"	77°42'33"
505043	Virudhunagar			Malli		
505044	Virudhunagar	Srivilliputthur	Srivilliputhur	Padikasukvaithanpatti	09°29'27"	77°36'40"
505045	Virudhunagar	Srivilliputthur	Srivilliputhur	Singammalpuram	09°31'19"	77°37'00"
505046	Virudhunagar	Srivilliputthur	Watrap	Iyankarisalkulam	09°38'46"	77°45'15"
505047	Virudhunagar	Srivilliputthur	Watrap	Kansapuram	09°38'05"	77°36'07"
505048	Virudhunagar	Srivilliputthur	Watrap	Khansahipuram West	09°37'31"	77°35'44"
505049	Virudhunagar	Srivilliputthur	Watrap	Kodikulam	09°38'41"	77°35'26"
505050	Virudhunagar	Srivilliputthur	Watrap	Kunnur	09°34'40"	77°42'09"
505051	Virudhunagar	Srivilliputthur	Watrap	Maharajapuram	09°39'32"	77°39'26"
505052	Virudhunagar	Srivilliputthur	Watrap	Nedunkulam	09°39'34"	77°36'01"
505053	Virudhunagar	Srivilliputthur	Watrap	Sundarapandiam	09°37'20"	77°40'37"
505054	Virudhunagar	Srivilliputthur	Watrap	Thambipatti	09°39'26"	77°40'50"
505055	Virudhunagar	Srivilliputthur	Srivilliputhur	Villupanur	09°33'27"	77°41'29"
505056	Virudhunagar	Srivilliputthur	Watrap	Watrap Ayacut	09°38'34"	77°37'34"
505057	Virudhunagar	Thirukuzhi	Thiruchuzhi	Muthaneri	09°32'13"	78°17'36"
505058	Virudhunagar	Thirukuzhi	Thiruchuzhi	Poolangai	09°18'42"	78°18'56"
505059	Virudhunagar	Thirukuzhi	Thiruchuzhi	Sudhmadam	09°21'19"	78°12'45"
505060	Virudhunagar	Virudunagar	Virudhunagar	Pavali	09°38'12"	77°55'27"

505061	Virudhunagar	Virudunagar	Virudhunagar	Periyavadi	09°27'52"	77°53'18"
505062	Virudhunagar	Virudunagar	Virudhunagar	Sengottai	09°30'51"	77°59'30"
505063	Virudhunagar	Virudunagar	Virudhunagar	Sennalkudi	09°30'39"	77°59'34"
505064	Virudhunagar	Virudunagar	Virudhunagar	Thamanaicken Patty	09°27'46"	77°54'04"
505065	Virudhunagar	Virudunagar	Virudhunagar	Thathampatti	09°32'27"	77°55'53"
505066	Virudhunagar	Virudunagar	Virudhunagar	V.muthulingapuram	09°30'23"	77°52'15"
505067	Virudhunagar	Virudunagar	Virudhunagar	Ondipulinaickanur		
83101	Virudhunagar	Srivilliputhur	Srivilliputhur	Srivilliputhur	09°30'15"	77°38'00"
83102	Virudhunagar	Srivilliputhur	Watrap	Watrap	09°38'00"	77°38'00"
83102 A	Virudhunagar	Srivilliputthur	Watrap	Watrap	09°38'28"	77°38'03"
83103	Virudhunagar	Rajapalayam	Rajapalayam	Rajapalayam	09°27'10"	77°33'20"
83103 A	Virudhunagar	Rajapalayam	Rajapalayam	Rajapalayam	09°27'00"	77°34'00"
83104	Virudhunagar	Rajapalayam	Rajapalayam	Sethur	09°24'10"	77°28'50"
83104A	Virudhunagar	Rajapalayam	Rajapalayam	Sethur	09°24'00"	77°29'00"
83104B	Virudhunagar	Rajapalayam	Rajapalayam	Seithur	09°24'10"	77°28'50"
83105	Virudhunagar	Rajapalayam	Rajapalayam	Ayyanarkoil	09°30'27"	77°27'00"
83105A	Virudhunagar	Rajapalayam	Rajapalayam	Ayyanarkoil	09°31'00"	77°27'00"
83106 C	Virudhunagar	Virudunagar	Kariapatti	Kariapatti	09°39'45"	78°05'53"
83106A	Virudhunagar	Aruppukkottai	Kariapatti	Kariapatti	09°45'00"	78°06'00"
83106B	Virudhunagar	Aruppukottai	Kariyapatti	Kariyapatti	09°41'00"	78°06'20"
83107	Virudhunagar	Aruppukottai	Aruppukottai	Aruppukottai	09°31'00"	78°06'00"
83107 A	Virudhunagar	Aruppukkottai	Aruppukkottai	Aruppukkottai	09°30'04"	78°05'48"

83108	Virudhunagar	Thiruchuli	Narikudi	Narikudi	09°36'00"	78°18'00"
83108 B	Virudhunagar	Thirukuzhi	Narikudi	Narikudi	09°35'25"	78°19'12"
83108A	Virudhunagar	Thirukuuli	Narikudi	Narikudi	09°35'15"	78°19'35"
83109	Virudhunagar	Thiruchuli	Thiruchuli	Thiruchuli	09°32'00"	78°12'00"
83110	Virudhunagar	Aruppukottai	Aruppukottai	Pandalkudi	09°24'00"	78°06'00"
83110A	Virudhunagar	Aruppukottai	Aruppukottai	Pandalkudi	09°24'00"	78°06'00"
83111	Virudhunagar	Thiruchuli	Thiruchuli	Mandabasalai	09°26'00"	78°13'00"
83111A	Virudhunagar	Thiruchuli	Thiruchuli	Mandapasalai	09°26'00"	78°13'00"
83112	Virudhunagar	Virudhunagar	Virudhunagar	Amathur	09°33'00"	77°52'00"
83112A	Virudhunagar	Virudhunagar	Virudhunagar	Amathur	09°33'00"	77°52'00"
83113	Virudhunagar	Virudhunagar	Virudhunagar	Virudhunagar	09°36'30"	77°57'00"
83113A	Virudhunagar	Virudhunagar	Virudhunagar	Virudhunagar	09°36'00"	77°57'00"
83114A	Virudhunagar	Sathur	Sathur	Sattur	09°21'00"	77°55'00"
83115	Virudhunagar	Sattur	Vembakottai	Vembakottai	09°20'00"	77°46'00"
83116	Virudhunagar	Sattur	Vembakottai	Alankulam	09°21'00"	79°30'00"
83116 A	Virudhunagar	Sivakasi	Vembakottai	Alangulam	09°21'33"	77°41'02"
83169	Virudhunagar	Rajapalayam	Rajapalayam	Vadakarai	09°20'10"	77°37'30"
83169B	Virudhunagar	Rajapalayam	Rajapalayam	Vadakarai	09°20'20"	77°37'30"
83169D	Virudhunagar	Rajapalayam	Rajapalayam	Kurichiyampatti	09°20'10"	77°37'10"
83170B	Virudhunagar	Rajapalayam	Rajapalayam	A.Salapuram	09°21'30"	77°33'50"
83170D	Virudhunagar	Rajapalayam	Rajapalayam	Kilavikulam	09°21'30"	77°35'50"
83171	Virudhunagar	Rajapalayam	Rajapalayam	Muddukudi	09°23'55"	77°33'40"
83172	Virudhunagar	Srivilliputhur	Rajapalayam	Reddiapatti	09°24'45"	77°39'10"

83173	Virudhunagar	Rajapalayam	Rajapalayam	Koiloor	09°23'00"	77°28'00"
83173 A	Virudhunagar	Rajapalayam	Rajapalayam	Koiloor	09°22'54"	77°27'39"
83174	Virudhunagar	Rajapalayam	Rajapalayam	Vadakku venganallur	09°29'50"	77°29'45"
83174 A	Virudhunagar	Rajapalayam	Rajapalayam	Vadakku Venganallur	09°27'14"	77°31'49"
83175	Virudhunagar	Srivilliputhur	Srivilliputhur	Mamsapuram	09°30'10"	77°35'10"
83175 A	Virudhunagar	Srivilliputthur	Srivilliputthur	Mamsapuram	09°29'56"	77°35'20"
83176	Virudhunagar	Srivilliputthur	Watrap	Khansahibpuram	09°38'00"	77°36'30"
83177	Virudhunagar	Srivilliputhur	Watrap	Kodikulam	09°38'55"	77°35'00"
83178	Virudhunagar	Srivilliputhur	Watrap	Kottaiyur	09°38'55"	77°42'05"
83178 A	Virudhunagar	Srivilliputthur	Watrap	Kottaiyur	09°39'08"	77°42'12"
83179	Virudhunagar	Srivilliputhur	Watrap	Alagapuri	09°38'00"	77°46'00"
83179 A	Virudhunagar	Srivilliputthur	Watrap	Alagapuri	09°38'17"	77°45'42"
83180	Virudhunagar	Srivilliputhur	Watrap	Nathampatti	09°36'10"	77°44'30"
83180 A	Virudhunagar	Srivilliputthur	Watrap	Nathampatti	09°35'36"	77°44'15"
83181	Virudhunagar	Srivilliputhur	Watrap	Valayapatti	09°33'50"	77°42'10"
83182	Virudhunagar	Srivilliputhur	Srivilliputhur	Pillaiyarnatham	09°33'00"	77°39'30"
83183	Virudhunagar	Srivilliputhur	Srivilliputhur	Pallaipattimalli	09°29'45"	77°41'45"
83183 A	Virudhunagar	Srivilliputthur	Srivilliputthur	Pallaipattimalli	09°29'39"	77°41'06"
83184	Virudhunagar	Srivilliputhur	Watrap	Perumalthevanpatti	09°27'42"	77°38'00"
83185	Virudhunagar	Sattur	Sattur	Meenakshipuram	09°18'10"	77°52'10"
83185A	Virudhunagar	Sathur	Sathur	Meenatchipuram	09°18'09"	77°52'00"
83186A	Virudhunagar	Virudunagar	Sivakasi	Saminatham	09°28'30"	77°43'32"

83187	Virudhunagar	Virudhunagar	Sivakasi	Vellahpuram	09°28'50"	77°47'10"
83187B	Virudhunagar	Virudhunagar	Sivakasi	Vellaihpuram	09°28'50"	77°47'10"
83188 B	Virudhunagar	Sivakasi	Sivakasi	M.pudupatti	09°32'39"	77°46'46"
83188A	Virudhunagar	Virudhunagar	Sivakasi	Mettupatti	09°33'30"	77°47'20"
83189	Virudhunagar	Virudhunagar	Virudhunagar	Sengundrapuram	09°37'00"	77°52'30"
83190	Virudhunagar	Virudhunagar	Virudhunagar	Usilampatti	09°38'00"	77°58'00"
83190 A	Virudhunagar	Virudunagar	Virudunagar	Chathira Rediapatti	09°37'26"	77°57'42"
83191	Virudhunagar	Sattur	Sivakasi	Vadamalaipatti	09°30'05"	77°50'30"
83192	Virudhunagar	Sattur	Sivakasi	Sengamalapatti	09°28'40"	77°50'15"
83193	Virudhunagar	Sattur	Sivakasi	Periyanaikenpatti	09°24'30"	77°47'00"
83193 A	Virudhunagar	Sivakasi	Sivakasi	Pernaickenpatti	09°24'43"	77°47'04"
83194	Virudhunagar	Sattur	Vembakottai	Chelliahpuram	09°20'40"	77°47'40"
83194 A	Virudhunagar	Sivakasi	Vembakottai	Vijaya Karisalkulam	09°20'40"	77°47'02"
83196	Virudhunagar	Sattur	Vembakottai	Valsapuram	09°16'10"	77°46'20"
83197A	Virudhunagar	Sattur	Sivakasi	Subramaniapuram	09°22'55"	77°50'05"
83198A	Virudhunagar	Sattur	Sivakasi	Anuppankulam	09°25'00"	77°50'45"
83199	Virudhunagar	Virudhunagar	Virudhunagar	Ettunaikenpatti	09°29'40"	77°56'30"
83200	Virudhunagar	Virudhunagar	Sattur	Naduvapatti	09°25'00"	77°55'00"
83200A	Virudhunagar	Virudhunagar	Sattur	Naduvapatti	09°25'00"	77°55'00"
83201	Virudhunagar	Sattur	Sattur	Pulvoypatti	09°15'00"	77°53'50"
83201 B	Virudhunagar	Virudunagar	Sathur	Pulvoypatti	09°14'56"	77°53'42"
83201A	Virudhunagar	Sattur	Sattur	Pulvoypatti	09°15'00"	77°52'00"

83202	Virudhunagar	Sattur	Sattur	Muliseval	09°16'00"	77°55'45"
83202 A	Virudhunagar	Virudunagar	Sathur	Muliseval	09°15'59"	77°55'45"
83203	Virudhunagar	Sathur	Sathur	Uppathur	09°15'08"	77°58'10"
83203 A	Virudhunagar	Virudunagar	Sathur	Uppathur	09°15'17"	77°58'09"
83204	Virudhunagar	Sattur	Sattur	N. Mettupatti	09°19'30"	77°53'50"
83205	Virudhunagar	Virudhunagar	Virudhunagar	A.Gopalapuram	09°26'00"	77°54'05"
83206	Virudhunagar	Aruppukottai	Aruppukottai	Malaipatti	09°29'00"	78°00'30"
83207	Virudhunagar	Aruppukottai	Aruppukottai	Palavanatham	09°33'00"	78°00'30"
83207 B	Virudhunagar	Aruppukkottai	Aruppukkottai	Palavanatham	09°33'19"	78°01'15"
83207A	Virudhunagar	Aruppukottai	Aruppukottai	Palavanatham	09°32'56"	78°00'36"
83208	Virudhunagar	Aruppukottai	Kariyapatti	Alagaianallur	09°37'07"	78°00'40"
83208 A	Virudhunagar	Virudunagar	Kariyapatti	Alagianallur	09°37'05"	78°01'30"
83209	Virudhunagar	Aruppukottai	Kariyapatti	Aviyur	09°44'30"	78°06'00"
83210	Virudhunagar	Aruppukottai	Kariyapatti	Vakkanankundu	09°38'00"	78°06'00"
83210 A	Virudhunagar	Virudunagar	Kariyapatti	Karianendal	09°37'37"	78°05'51"
83211	Virudhunagar	Aruppukottai	Aruppukottai	Ramanajapuram	09°33'30"	78°05'15"
83211 A	Virudhunagar	Aruppukkottai	Aruppukkottai	Kovilangulam	09°33'30"	78°06'32"
83212	Virudhunagar	Aruppukottai	Aruppukottai	Sivanthivinayagapuram	09°26'40"	78°06'00"
83213	Virudhunagar	Thiruchli	Aruppukottai	Mangalam	09°29'40"	78°09'45"
83213 B	Virudhunagar	Aruppukkottai	Aruppukkottai	Kulasekaranallur	09°29'58"	78°08'54"
83213A	Virudhunagar	Thiruchuli	Aruppukottai	Mangalam	09°29'40"	78°09'45"
83214	Virudhunagar	Thiruchuli	Thiruchuli	Muthuramalingapuram	09°28'00"	78°10'00"

83215	Virudhunagar	Thiruchuli	Thiruchuli	Rajagopalapuram	09°21'00"	78°15'00"
83215 A	Virudhunagar	Aruppukkottai	Thiruchuli	Melaiyur	09°20'52"	78°16'05"
83216	Virudhunagar	Thiruchuli	Thiruchuli	Sengulam	09°19'50"	78°17'30"
83216 A	Virudhunagar	Aruppukkottai	Thiruchuli	Paralachi	09°20'14"	78°17'15"
83217	Virudhunagar	Thiruchuli	Thiruchuli	Anaikulam	09°29'00"	78°17'00"
83217 A	Virudhunagar	Thirukuzhi	Thiruchuli	Anaikulam	09°28'55"	78°17'20"
83218 B	Virudhunagar	Thirukuzhi	Thiruchuli	Panaiyur	09°30'13"	78°14'09"
83218A	Virudhunagar	Thiruchuli	Thiruchuli	Panaiyur	09°31'00"	78°15'00"
83219	Virudhunagar	Thiruchuli	Narikudi	Udhaiyanendal	09°34'00"	78°00'10"
83220	Virudhunagar	Thiruchuli	Narikudi	Vidthakulam	09°32'45"	78°17'20"
83221	Virudhunagar	Thiruchuli	Thiruchuli	Puthanendal	09°38'30"	78°23'00"
83222	Virudhunagar	Thirukuzhi	Narikudi	Veeracholan	09°32'40"	78°22'00"
83222 B	Virudhunagar	Thirukuzhi	Narikudi	Veeracholan	09°33'11"	78°21'42"
83222A	Virudhunagar	Thiruchuli	Narikudi	Veeracholan	09°32'40"	78°22'00"
83223	Virudhunagar	Aruppukottai	Kariyapatti	Maraikulam	09°37'10"	78°15'15"
83224	Virudhunagar	Aruppukottai	Kariyapatti	Sriramboor	09°40'00"	78°11'30"
83224A	Virudhunagar	Aruppukkottai	Kariapatti	Sriambur	09°39'37"	78°10'19"
83225	Virudhunagar	Aruppukottai	Kariyapatti	Mustakurichi	09°20'00"	78°06'30"
83225A	Virudhunagar	Aruppukkottai	Kariapatti	Mustakurichi	09°43'00"	78°08'56"
83226	Virudhunagar	Thiruchuli	Narikudi	Manickanendal	09°20'00"	78°10'00"
83227	Virudhunagar	Thiruchuli	Narikudi	Alagapuri	09°04'00"	78°16'00"
83227 A	Virudhunagar	Thirukuzhi	Narikudi	A.mookkulam	09°40'56"	78°15'07"
83228	Virudhunagar	Thiruchuli	Narikudi	Pulvaykarai	09°43'00"	78°13'20"

Virudhunagar District - Piezometers - Location and Co-ordinates

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
25001D	Virudhunagar	Srivilliputhur	Srivilliputhur	Srivilliputhur	9.516667	77.633333
25002D	Virudhunagar	Srivilliputhur	Srivilliputhur	Mamsapuram	9.511111	77.583333
25003A	Virudhunagar	Srivilliputhur	Srivilliputhur	Pillaiyarnathem	9.550000	77.658333
25004M	Virudhunagar	Srivilliputhur	Watrap	Vadugapatti	9.633333	77.766667
25005A	Virudhunagar	Srivilliputhur	Watrap	Valayapatti	9.563889	77.700000
25006D	Virudhunagar	Thiruchuli	Thiruchuli	Thiruchuli	9.536111	78.201389
25007D	Virudhunagar	Aruppukottai	Aruppukottai	Pandalkudi	9.400000	78.100000
25008D	Virudhunagar	Rajapalayam	Rajapalayam	Seithur	9.408333	77.480556
25009A	Virudhunagar	Rajapalayam	Rajapalayam	Kollankondan	9.508333	77.475000
25010D	Virudhunagar	Rajapalayam	Rajapalayam	Therkuvenkanallur	9.395833	77.552778
25011D	Virudhunagar	Rajapalayam	Rajapalayam	Kovilur	9.377778	77.469444
25012A	Virudhunagar	Aruppukkottai	Aruppukottai	Aruppukottai	9.527222	78.100278
25012D	Virudhunagar	Aruppukottai	Aruppukottai	Aruppukottai	9.533333	78.100000
25013D	Virudhunagar	Thiruchuli	Thiruchuli	Mandapasalai	9.422222	78.225000
25014D	Virudhunagar	Aruppukottai	Arupukottai	Kovilankulam	9.563889	78.090278
25015D	Virudhunagar	Srivilliputhur	Watrap	Watrap	9.626389	77.636111
25016D	Virudhunagar	Rajapalayam	Rajapalayam	Rajapalayam	9.469444	77.558333
25017D	Virudhunagar	Aruppukottai	Aruppukottai	Chettikuruchi	9.433333	78.101389
25018A	Virudhunagar	Thirukuzhi	Thiruchuli	Mangulam	9.497778	78.150278
25018D	Virudhunagar	Tiruchuli	Tiruchuli	Muthuramalingapuram	9.494444	78.154167
25019A	Virudhunagar	Aruppukkottai	Kariapatti	Vakkanankundu	9.633056	78.095278
25019D	Virudhunagar	Aruppukottai	Kariyapatti	Vakkanangundu	9.630556	78.100000
25020D	Virudhunagar	Virudhunagar	Virudhunagar	Amathur	9.563889	77.858333
25021D	Virudhunagar	Virudhunagar	Virudhunagar	Virudhunagar	9.608333	77.950000
25022D	Virudhunagar	Sattur	Sattur	Sattur	9.352778	77.916667
25023D	Virudhunagar	Virudhunagar	Virudhunagar	Chattirareddipatti	9.636111	77.958333
25024D	Virudhunagar	Sattur	Sattur	Mulliseval	9.280556	77.930556
25025D	Virudhunagar	Sattur	Sattur	Uppathur	9.251389	77.980556
25026	Virudhunagar	Virudhunagar	Virudhunagar	Pattampudur	9.494444	77.938889
25027	Virudhunagar	Sattur	Vembakottai	Duraisamypuram	9.436111	77.719444
25028	Virudhunagar	Sattur	Vembakottai	Gananjampatty	9.372222	77.779167
25029	Virudhunagar	Sattur	Sivakasi	Mangalam	9.570833	77.756944
25030	Virudhunagar	Aruppukottai	Kariyapatti	P.Pudupatti	9.597222	78.162500
25031	Virudhunagar	Aruppukottai	Aruppukottai	Amanakkunatham	9.455556	78.054167
25032	Virudhunagar	Srivilliputhur	Watrap	Kodikulam.s	9.650000	77.587500
25032A	Virudhunagar	Srivilliputthur	Watrap	Kodikulam.s	9.647778	77.585278
25072 HP II	Virudhunagar	Thirukuzhi	Kariyapatty	Alagianallur	9.621389	78.010833
25073	Virudhunagar	Sathur	Vembakottai	Sankarapandiapuram	9.295278	77.785278
25074	Virudhunagar	Rajapalayam	Rajapalayam	Seithur	9.420556	77.466389

25075	Virudhunagar	Sathur	Sathur	N.mettupatti	9.333056	78.003611
25076	Virudhunagar	Aruppukkottai	Aruppukkottai	Kanjanaickenpatti	9.504444	78.096111
25077	Virudhunagar	Rajapalayam	Rajapalayam	Maravarperungudi	9.420556	77.466389
25078	Virudhunagar	Sathur	Sathur	Chinnakamanpatti	9.416389	77.866111
25079	Virudhunagar	Sathur	Sathur	Padanthal	9.358889	77.899722
25080	Virudhunagar	Aruppukkottai	Virudunagar	Villipathiri	9.594444	77.998056
25081	Virudhunagar	Virudunagar	Virudunagar	Irungirai	9.580833	78.361111
25082	Virudhunagar	Virudunagar	Kariyapatty	Sathirampuliankulam	9.655833	77.152778
25083	Virudhunagar	Virudunagar	Kariyapatty	S.thoppur	9.652500	78.123611
25084	Virudhunagar	Virudunagar	Kariyapatty	Keelakanjirankulam	9.609722	78.180556
25085	Virudhunagar	Virudunagar	Kariyapatty	Manamkathan	9.608889	78.223611
25086	Virudhunagar	Virudunagar	Virudhunagar	Kottanatham	9.473611	77.955556
25087	Virudhunagar	Virudunagar	Virudhunagar	Ondipulinaickanur	9.521667	77.898333
25088	Virudhunagar	Thirukuzhi	Narikudi	Mayaleri	9.608333	78.357500
25089	Virudhunagar	Aruppukkottai	Aruppukottai	Palavanatham	9.539167	77.033889
25090	Virudhunagar	Sathur	Sathur	Subramaniyapuram	9.671667	78.177222
25091	Virudhunagar	Aruppukkottai	Kariyapatti	Thonugal	9.633333	78.083611
25092	Virudhunagar	Sivakasi	Sivakasi	Vellur	9.566111	77.846111
25093	Virudhunagar	Sivakasi	Sivakasi	Nameskarithampatti	9.518333	77.790833
25094	Virudhunagar	Sivakasi	Vembakottai	Keelanmarainadu	9.324722	77.703611
25095	Virudhunagar	Sivakasi	Sivakasi	Vadapatti	9.526389	77.782500

(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 Virudhunagar 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 evapo transpiration, 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

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

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)

VIRUDHUNAGAR DISTRICT							
Sl.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	VIRUDHUNAGAR	53,344.37	31,730.44	2,017.71	33,748.15	63	5

Firka Wise Summary

(in ha.m)

VIRUDHUNAGAR DISTRICT							
Sl.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.MUKKULAM	2,277.36	188.50	28.90	217.40	10	SAFE
2	AMATHUR	1,148.56	808.43	19.84	828.26	72	SEMI CRITICAL
3	ARUPPUKOTTAI	285.39	28.25	10.37	38.62	14	SAFE
4	CHOLAPURAM	1,680.09	2,183.40	20.72	2,204.12	131	OVER EXPLOITED
5	ELAYIRAM-PANNAI	1,356.70	1,049.60	36.21	1,085.81	80	SEMI CRITICAL
6	ETHIRKOTTAI	1,342.87	1,404.90	17.43	1,422.33	106	OVER EXPLOITED
7	IYANKOLLANKONDAN	1,582.54	1,153.80	13.84	1,167.64	74	SEMI CRITICAL

VIRUDHUNAGAR DISTRICT

Sl.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
8	KALKURUCHI	683.37	375.90	70.23	446.13	65	SAFE
9	KARIAPATTI	2,499.25	680.78	44.52	725.30	29	SAFE
10	KEELARAJAKULARAMAN	1,418.77	2,116.80	244.34	2,361.14	166	OVER EXPLOITED
11	KOTTAIYUR	1,788.72	1,335.60	16.06	1,351.66	76	SEMI CRITICAL
12	MALLANKINAR	633.18	584.55	36.71	621.26	98	CRITICAL
13	MALLI	1,716.16	1,237.95	13.69	1,251.64	73	SEMI CRITICAL
14	MANDAPASALAI	1,237.06	794.40	60.62	855.02	69	SAFE
15	MANGALAM	2,097.59	1,969.20	37.49	2,006.69	96	CRITICAL
16	MUDUKKAN-KULAM	2,262.94	115.70	94.20	209.90	9	SAFE
17	NALLI	734.55	488.70	59.26	547.96	75	SEMI CRITICAL
18	NARIKUDI	3,135.57	107.35	57.84	165.19	5	SAFE
19	NATHAMPATTI	897.35	1,301.40	15.64	1,317.04	147	OVER EXPLOITED
20	NENMENI	681.37	439.65	4.27	443.92	65	SAFE
21	ONDIPULINAICKANUR	809.38	621.00	20.57	641.57	79	SEMI CRITICAL
22	PALAYAMAPATTI	1,077.99	471.60	19.84	491.44	46	SAFE
23	PANDALKUDI	1,277.17	281.70	32.45	314.15	25	SAFE
24	PARALATCHI	1,737.80	364.43	470.67	835.09	48	SAFE
25	PILLAIYARKULAM	1,557.83	1,604.70	19.21	1,623.91	104	OVER EXPLOITED
26	RAJAPALAYAM	1,017.91	863.10	4.00	867.10	85	SEMI CRITICAL
27	SALWARPATTI	1,081.11	1,004.40	48.96	1,053.36	97	CRITICAL
28	SATTUR	1,449.17	830.70	52.96	883.66	61	SAFE
29	SEITHUR	3,087.50	1,589.40	74.10	1,663.50	54	SAFE
30	SIVAKASI	1,041.29	809.14	0.97	810.11	78	SEMI CRITICAL

31	SRIVILLIPUTTUR	1,178.73	924.30	23.87	948.17	80	SEMI CRITICAL
32	THIRUCHULI	1,968.53	439.43	212.56	651.99	33	SAFE
33	VATCHAKARA-PATTI	886.10	790.20	79.09	869.29	98	CRITICAL
34	VEERACHOLAN	2,529.54	540.00	7.79	547.79	22	SAFE
35	VIRUDHUNAGAR	351.61	178.50	41.02	219.52	62	SAFE
36	WATRAP	2,833.31	2,053.00	7.51	2,060.51	73	SEMI CRITICAL
TOTAL		**53,344.37**	**31,730.44**	**2,017.71**	**33,748.15**	**63**	

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 Virudhunagar 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) <u>Statute/Law/Policy/Regulations if any</u>:

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) <u>Suggestions for improvement of groundwater governance</u>.

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) <u>Institutions governing/managing/monitoring the resources and Institutional structure, gaps if any</u> :

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) <u>Areas of people/private participation if any</u>:

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 11 blocks in Virudhunagar District, 5 blocks are categorized as Over Exploited and Critical blocks and remaining 6 blocks are categorized as Semi Critical and 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 Virudhunagar District, totally 36 Firkas, 12 Firkas are categorized as Over Exploited and remaining 24 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 45.45%, but, the total percentage of over exploited and critical Firkas as on March 2011 Assessment is 33.33%, in the Virudhunagar 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 36 Firkas, the total percentage of over exploited and critical Firkas is 33.33%, but, In 2013 assessment, out of 36 Firkas, it has been come down to 25.00%, in the Virudhunagar 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 36 Firkas in the District, 5 Firkas are categorized as “Over Exploited Firkas”, 4 Firkas are categorized as “Critical Firkas”, 11 Firkas are categorized as “Semi Critical Firkas”, 16 Firkas are categorized as “Safe Firkas”.

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 36 Firkas in the State, 5 Firkas are categorized as “Over Exploited Firkas”, 7 Firkas are categorized as “Critical Firkas”, 9 Firkas are categorized as “Semi Critical Firkas”, 15 Firkas are categorized as “Safe Firkas”.

When compared to last assessment as on March 2011, There is no change in “Over Exploited”,the “Critical Firkas” decreased from 7 to 4 Firkas, the “Semi Critical Firkas” increased marginally from 9 to 11 Firkas, the “Safe Firkas” increased from 15 to 16 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	5	5
2	Critical	7	4
3	Semi Critical	9	11
4	Safe	15	16
5	Saline	Nil	Nil
TOTAL		36	36

(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.