CHAPTER 4.1.9 GROUND WATER RESOURCES

PUDUKOTTAI DISTRICT

INDEX

GROUND WATER REPORT OF PUDUKOTTAI 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 total geographical area of Pudukottai district is 4, 66,329 hectares accounting for 3.58% of the total geographical area of Tamilnadu State. The area lies within the co-ordinates Latitude: 9º51'00"- 10º44'40" & Longitude: 78º25'30"-79º16'15".The districts well connected to other parts of the State by means of for administrative purposes, Pudukottai Town is the District Head Quarters.

Pudukottai District is totally bifurcated into 11 Firkas.

1. HYDROGELOGY

(i) Major Geological formations:

Geology

Geologically the entire district can be broadly classified into hard rock and sedimentary regions.

a) Hard rock regions

Around 45% of this district is underlain by hard massive formations of Archaean age. Granitic gneiss, hornblende biotite gneiss, charnockites, pegmatites and quartzites are the various types of rocks encountered in the hard rock region. Kulathur, major part of Thirumayam and parts of Pudukottai taluk are occupied by crystalline rocks.

b) Sedimentary regions

The area occupied by sedimentary formations belonging to 1. Cretaceous 2.Tertiary and 3. Recent ages fall on the eastern half of the district. The total extent occupied by sedimentary formations amounts to 55% of the total geographical area of the district. Tertiary deposits of Pudukottai district consists of laterite, arenaceous and argillaceous sand stone and clay.

Cretaceous deposits consists of clay, limestone, sand stone and clayey sand stone. The coastal alluvial deposits consists of unconsolidated sands, gravels and clay. Aranthangi, major parts of Gandarvakottai, Alangudi, Avudaiyarkoil and half of Manamelkudi and Pudukottaitaluks are occupied by tertiary deposits. Minor parts of Gandarvakottai, Thirumayam and half of Pudukottai taluks are occupied by cretaceous deposits. Half of Manamelkudi and minor parts of Avudaiyarkoil taluks are occupied by Quarternary deposits.

Drilling of bore holes:

The occurrence and movement of groundwater in hard rock formations are restricted to the porous zones of weathered formations and the open systems of fractures, fissures and joints. Generally, in hard rock regions, occurrence of weathered thickness is discontinuous both in space and depth. Hence recharge of groundwater in hard rock formations is influenced by the intensity and depth of weathering. The subsurface lithological condition and the aquifer characters can be ascertained by drilling exploratory boreholes and conducting pump tests.

The State Ground and Surface Water Resources Data Centre, during the course of investigation has drilled more than 92 boreholes spread over the entire district to find out the nature and behaviour of the subsurface material and their water holding and water yielding capability. The weathering zone in the district varies from 7 to 22 metres below ground level.

Aquifer parameters:

a) Hard rock

The thickness of aquifer in Pudukottai district varies between 12 m to 45 m below G.L. The intensity and degree of weathering and fracture development in the crystalline

formations play a vital role in the development of intergranular porosity. Whenever gneissic formations occur deep and very high intensity of weathering is observed. While in charnockite area weathering is moderate. The aquifer parameter in hard rock region of the district is observed to be as follows:

Parameters	Range
Well yield in LPM	1-2lpm
Transmissivity (T) m^2/day	5-25 m^2/day
Permeability (K) m/day	3-16 m/day

b) Sedimentary formations

i) Cretaceous formations

The cretaceous formations are the oldest among the sedimentary formations occurring in the district, cropping out along a narrow belt of 6-8 kms width adjoining the archaean complex. These formations are found in the eastern parts of Thirumayamtaluk and nearly in the half of pudukottai, alangudi and Gandarvakottai. Taluks, consists mainly of coarse grained sand, clay, clayey sand stone associated with kankar and gravel. The aquifer parameter values of the cretaceous formations are given below.

Parameters	Range
Well yield in LPM	3-4lpm
Transmissivity (T) m^2/day	9-47 m^2/day
Permeability (K) m/day	0.5-2.80 m/day

ii) Tertiary formations:

The tertiary formations encountered in this district are of Miocene and Pilocene ages and are found in the entire Aranthangiand Avudaiyarkoiltaluks and also along the eastern parts of the pudukottai and alanguditaluks consisting mainly of sandstones, clay bound sands, sandy clay, shales, etc., The aquifer parameters values of tertiary formations are given below:

Parameters	**Range**
Well yield in LPM	5-10lpm
Transmissivity (T) m^2/day	89-157 m^2/day
Permeability (K) m/day	1.5-3 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 Pudukottai 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 Pudukottai District,108 observation wells and 51 piezometers,totally 159 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 Pudukottai 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 Pudukottai District. The analysis reveals that the water level has gone down in the north, west and central parts of the Pudukottai 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 Pudukottai District.

(iii) Existing network of Monitoring wells:

In Pudukottai District, the existing network of monitoring wells is 159 wells, 108 wells are observation wells and 51 wells are piezometers. These wells are observed for every month water level.

Pudukkottai District: Observation Wells - Location and Co-ordinates

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
43034	Pudukkottai	Kulathur	Kunnandarkoil	Keeranur	10°34'15"	78°47'30"
43044	Pudukkottai	Avudayarkoil	Manamelkudi	Kattumavadi	10°07'45"	79°13'30"
43045	Pudukkottai	Arantangi	Arantangi	Nagaram	10°10'20"	79°00'00"
43077	Pudukkottai	Gandarvakottai	Gandarvakottai	Mudukulam	10°35'03"	79°04'50"
43077A	Pudukkottai	Gandarvakottai	Gandarvakottai	Mudukulam	10°35'03"	79°04'50"
43078	Pudukkottai	Pudukkottai	Pudukkottai	Adanakkotta i	10°31'10"	78°57'30"
43079	Pudukkottai	Pudukkottai	Pudukkottai	Ganapathip uram	10°31'48"	79°01'20"
43080	Pudukkottai	Pudukkottai	Pudukkottai	Mandangudi	10°28'00"	78°55'00"
43081AY	Pudukkottai	Pudukkottai	Pudukkottai	Vellayakkon patti	10°25'10"	78°52'10"
43082	Pudukkottai	Pudukkottai	Pudukkottai	Semmattivid udi	10°25'48"	78°58'20"
43083	Pudukkottai	Alangudi	Karambakudi	Pallavaranp atti	10°26'50"	79°05'25"
43084	Pudukkottai	Alangudi	Thiruvarankula m	Venkatakula m	10°19'25"	78°55'35"
43085	Pudukkottai	Alangudi	Thiruvarankula m	Nagaram	10°17'45"	79°05'30"
43086	Pudukkottai	Arantangi	Arantangi	Nagudi	10°09'11"	79°06'35"
43087	Pudukkottai	Avudayarkoil	Manamelkudi	Manamelku di	10°02'20"	79°13'50"
43087A	Pudukkottai	Manamelgudi		Manamelgu di	10°02'20"	79°13'50"

43088	Pudukkottai	Avudayarkoil	Manamelkudi	Mimisal	09°55'10"	79°08'30"
43090	Pudukkottai	Avudayarkoil	Avudayarkoil	Okkur	10°02'00"	79°01'00"
73110	Pudukkottai	Kulathur	Viralimalai	Kalkudi	10°39'20"	78°32'51"
73110A	Pudukkottai	Illuppur	Viralimalai	Viralimalai	10°36'41"	78°32'55"
73111	Pudukkottai	Kulathur	Viralimalai	Kumarappatti	10°40'02"	78°37'58"
73111A	Pudukkottai	Gandarvakottai		Thennilaipatti	10°40'02"	78°37'58"
73112	Pudukkottai	Kulathur	Viralimalai	Mandaiyur	10°39'10"	78°43'25"
73113	Pudukkottai	Kulathur	Kunnandarkoil	Chettipatti	10°35'12"	78°39'30"
73114	Pudukkottai	Kulathur	Kunnandarkoil	Sengalure	10°39'45"	78°53'24"
73119	Pudukkottai	Kulathur	Annavasal	Viralur	10°34'22"	78°32'45"
73120	Pudukkottai	Kulathur	Annavasal	Tirunallur	10°35'03"	78°37'15"
73121	Pudukkottai	Kulathur	Viralimalai	Vilapatti	10°34'25"	78°43'00"
73122	Pudukkottai	Kulathur	Kunnandarkoil	Nanjoore	10°34'40"	78°48'34"
73122A	Pudukkottai	Gandarvakottai		Melapattinanjur	10°34'40"	78°48'34"
73123	Pudukkottai	Kulathur	Kunnandarkoil	Vattankottai	10°34'28"	78°53'27"
73123A	Pudukkottai	Gandarvakottai		Kukoor	10°34'28"	78°53'27"
73124	Pudukkottai	Alangudi	Karambakudi	Kilangadu	10°34'18"	79°09'20"
73125	Pudukkottai	Gandarvakottai	Gandarvakottai	Sottuppalai	10°34'12"	78°59'28"
73125A	Pudukkottai	Gandarvakottai	Gandarvakottai	Uriyappatti	10°34'12"	78°59'28"
73130	Pudukkottai	Kulathur	Annavasal	Idaiyappatti	10°29'41"	78°37'40"
73131	Pudukkottai	Kulathur	Annavasal	Keelakurichi	10°29'38"	78°43'35"
73132	Pudukkottai	Kulathur	Annavasal	Muttukkadu	10°29'25"	78°48'39"
73133A	Pudukkottai	Pudukkottai	Pudukkottai	Lakshmipuram	10°29'41"	78°54'43"

73133AY	Pudukkottai	Pudukkottai	Pudukkottai	Pudukkottai	10°29'41"	78°54'43"
73134	Pudukkottai	Pudukkottai	Pudukkottai	Varappur	10°28'15"	78°58'45"
73135	Pudukkottai	Alangudi	Karambakudi	Karuppattipatti	10°29'02"	79°03'08"
73135A	Pudukkottai	Alangudi		Karuppattipatti	10°29'02"	79°03'08"
73136	Pudukkottai	Alangudi	Karambakudi	Tittanviduthy	10°28'30"	79°08'46"
73139	Pudukkottai	Thirumayam	Ponnamaravathi	Maravamadurai	10°23'40"	78°33'18"
73140	Pudukkottai	Thirumayam	Ponnamaravathi	Karanapatti	10°23'56"	78°37'56"
73140A	Pudukkottai	Thirumayam		Sadayampatti	10°23'56"	78°37'56"
73141	Pudukkottai	Kulathur	Annavasal	Vayalogam	10°23'56"	78°37'56"
73142	Pudukkottai	Pudukkottai	Pudukkottai	Pudukkottai	10°23'23"	78°48'12"
73143	Pudukkottai	Pudukkottai	Pudukkottai	Veppangudi	10°33'43"	78°53'37"
73143A	Pudukkottai	Pudukkottai		Nerunjipatti	10°28'23"	78°58'44"
73144	Pudukkottai	Alangudi	Karambakudi	Mangottai	10°23'45"	78°58'33"
73145	Pudukkottai	Alangudi	Karambakudi	Pallavaranpathai	10°26'15"	79°04'30"
73145A	Pudukkottai	Alangudi		Kendaiyantheru	10°26'15"	79°04'30"
73146	Pudukkottai	Alangudi	Karambakudi	Eachanvidut hi	10°21'10"	79°09'10"
73146A	Pudukkottai	Alangudi		Echanviduth i	10°21'10"	79°09'10"
73148	Pudukkottai	Thirumayam	Ponnamaravathi	Thuthur	10°18'36"	78°32'45"
73149	Pudukkottai	Thirumayam	Ponnamaravathi	Mekkinippatti	10°18'36"	78°38'10"
73150	Pudukkottai	Thirumayam	Thirumayam	Lembalakudy	10°18'38"	78°43'34"
73151	Pudukkottai	Thirumayam	Arimalam	Perungudi	10°10'45"	78°48'20"
73152	Pudukkottai	Alangudi	Thiruvarankulam	Avudayapatti	10°18'41"	78°54'02"
73153	Pudukkottai	Alangudi	Thiruvarankulam	Arayapatti	10°18'16"	78°58'33"

73153A	Pudukkottai	Alangudi		Araypatti	10°18'16"	78°58'33"
73154	Pudukkottai	Alangudi	Thiruvarankulam	Mangadu	10°19'20"	79°05'25"
73154A	Pudukkottai	Alangudi		Mangadu	10°19'20"	79°05'25"
73155	Pudukkottai	Thirumayam	Thirumayam	Thunaiyanur	10°13'20"	78°43'14"
73156	Pudukkottai	Thirumayam	Arimalam	Kannankarakudy	10°13'20"	78°47'40"
73157	Pudukkottai	Thirumayam	Arimalam	Keelapanaiyur	10°13'45"	78°53'24"
73158	Pudukkottai	Thirumayam	Avudayarkovil	Mathagam	10°03'22"	78°57'35"
73158A	Pudukkottai	Aadudayarkoil		Madagam	10°03'22"	78°57'35"
73159	Pudukkottai	Aranthangi	Aranthangi	Kasavayal	10°05'54"	79°06'34"
73160	Pudukkottai	Alangudi	Alangudi	Maruthakon eviduthi	10°31'16"	79°07'14"
73161	Pudukkottai	Gandarvakottai	Gandarvakottai	Thachankurichi	10°40'07"	78°59'14"
73162	Pudukkottai	Thirumayam	Arimalam	Kallur Rayavaram	10°09'07"	78°50'50"
73163	Pudukkottai	Kolathur	Kunnandarkovil	Puliyur	10°38'03"	78°50'22"
73164	Pudukkottai	Illuppur	Viralimalai	Malampatti	10°36'15"	78°39'39"
73165	Pudukkottai	Thirumayam	Arimalam	Namanasamudiram	10°19'46"	78°46'21"
73166	Pudukkottai	Thirumayam	Arimalam	Menampatti	10°16'05"	78°49'50"
73167	Pudukkottai	Pudukkottai	Pudukkottai	Melakayampatti	10°23'37"	78°53'16"
73168	Pudukkottai	Alangudi	Thiruvarankulam	Keelathur	10°21'27"	79°02'05"
73169	Pudukkottai	Alangudi	Thiruvarankulam	Alagambalpuram	10°20'30"	78°52'08"
73170	Pudukkottai	Alangudi	Karambakudi	Pallavarayanpathai	10°26'33"	79°05'38"
73171	Pudukkottai	Gandarvakottai	Gandarvakottai	Punalkulam	10°39'08"	79°03'06"

73172	Pudukkottai	Gandarvakottai	Gandarvakottai	Manganoor	10°36'24"	78°58'10"
73173	Pudukkottai	Gandarvakottai	Gandarvakottai	Cholagampatti	10°39'01"	78°57'27"
73174	Pudukkottai	Kolathur	Kunnandarkovil	Killukkottai	10°39'04"	78°55'24"
73175	Pudukkottai	Kolathur	Kunnandarkovil	Kumarapatti	10°33'01"	78°51'24"
73176	Pudukkottai	Kolathur	Viralimalai	Mathur	10°41'05"	78°44'31"
73177	Pudukkottai	Illuppur	Annavasal	Aunappatti	10°25'10"	78°29'14"
73178	Pudukkottai	Illuppur	Viralimalai	Kodalikudi	10°36'03"	78°30'20"
73179	Pudukkottai	Aranthangi	Aranthangi	Erichi	10°13'45"	78°58'40"
73180	Pudukkottai			Rakkathampatti		
73275	Pudukkottai	Pudukkottai	Pudukkottai	Pudukkottai	10°21'37"	78°48'25"
73275A	Pudukkottai	Pudukkottai	Pudukkottai	Malaiyeedu	10°21'37"	78°48'25"
73276	Pudukkottai	Pudukkottai	Pudukkottai	Pudukkottai	10°23'00"	78°49'00"
73281	Pudukkottai	Arantangi	Arantangi	Arantangi	10°10'10"	79°00'00"
73281A	Pudukkottai	Aranthangi		Aranthangi	10°10'10"	79°00'00"
73358	Pudukkottai			Rakkathampatti		
77324	Pudukkottai	Avudayarkoil	Avudayarkoil	Avudayarkoil	10°04'25"	79°02'25"
MMWS PDK 1	Pudukkottai			Verappatti	10°28'41"	78°40'12"
MMWS PDK 10	Pudukkottai	Aadudayarkoil	Illuppur	Paiyur	10°34'27"	78°39'45"
MMWS PDK 11	Pudukkottai	Alangudi		Irundirapatti	10°32'11"	78°38'00"
MMWS PDK 12	Pudukkottai	Kolathur	Kulathur	Lactumanapatti	10°37'37"	78°46'55"
MMWS PDK 13	Pudukkottai	Gandarvakottai	Thirumayam	Gandarvakottai	10°34'28"	79°01'01"
MMWS PDK 14	Pudukkottai	Gandarvakottai	Kulathur	Minnathur	10°34'16"	78°56'51"
MMWS PDK 15	Pudukkottai	Gandarvakottai	Viralimalai	Uppllgudi	10°31'47"	78°48'08"

MMWS PDK 16	Pudukkottai	Illupur	Viralimalai	Rappusal	10°32'03"	78°41'42"
MMWS PDK 17	Pudukkottai	Illupur	Viralimalai	Odukkur	10°33'23"	78°45'02"
MMWS PDK 18	Pudukkottai	Gandarvakottai	Kulathur	Nallur	10°38'54"	78°44'35"
MMWS PDK 19	Pudukkottai	Alangudi		Vellanur	10°27'29"	78°47'42"
MMWS PDK 2	Pudukkottai			Parampur	10°25'48"	78°38'10"
MMWS PDK 20	Pudukkottai	Aadudayarkoil	Annavasal	Kumarapatti	10°39'49"	78°36'58"
MMWS PDK 5	Pudukkottai			Sanikkadu	10°10'32"	78°57'59"
MMWS PDK 6	Pudukkottai			Palaiyur	10°16'22"	78°54'25"
MMWS PDK 9	Pudukkottai	Alangudi	Illupur	Mullaiyur	10°36'27"	78°35'37"

Pudukottai District - Piezometers - Location and Co-ordinates

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
12001 D	Pudukkottai	Kolathur	Viralimalai	Mandaiyur	10.650000	78.725000
12002 D	Pudukkottai	Illuppur	Viralimalai	Vilappatti	10.566667	78.712500
12003 D	Pudukkottai	Kolathur	Kunnandarkovil	Settippatti	10.666667	78.808333
12004 D	Pudukkottai	Illuppur	Viralimalai	Viralur	10.572222	78.545833
12005	Pudukkottai	Illuppur	Annavasal	Thirunallur	10.583333	78.618056
12006	Pudukkottai	Kolathur	Kunnandarkovil	Vattanakottai	10.575000	78.891667
12007 D	Pudukkottai	Kolathur	Kunnandarkovil	Nanjur	10.575000	78.808333
12008 D	Pudukkottai	Kolathur	Annavasal	Muttukkadu	10.484722	78.808333
12009 D	Pudukkottai	Illuppur	Annavasal	Idaiyapatti	10.495833	78.629167
12010	Pudukkottai	Thirumayam	Ponnamaravathi	Maravamadurai	10.395833	78.552778
12011 D	Pudukkottai	Thirumayam	Ponnamaravathi	Thuthur	10.313333	78.543056
12012 D	Pudukkottai	Thirumayam	Ponnamaravathi	Karanapatti	10.391667	78.631944
12013 D	Pudukkottai	Illuppur	Viralimalai	Komengalam	10.701389	78.562500
12014 D	Pudukkottai	Illuppur	Viralimalai	Kodumbalure	10.547222	78.512500
12015	Pudukkottai	Illuppur	Viralimalai	Sevalpatti	10.569444	78.469444
12016 D	Pudukkottai	Kolathur	Viralimalai	Madhayanipatti	10.638889	78.647222
12017	Pudukkottai	Illuppur	Annavasal	Thalinji	10.487500	78.588889

12018 D	Pudukkottai	Illuppur	Annavasal	Rappoosal	10.526389	78.687500
12019	Pudukkottai	Illuppur	Annavasal	Mampatti	10.452778	78.618056
12020 D	Pudukkottai	Thirumayam	Thirumayam	Rangaiyam	10.227778	78.651389
12021 D	Pudukkottai	Thirumayam	Thirumayam	Manjinippatti	10.155556	78.683333
12022 D	Pudukkottai	Thirumayam	Thirumayam	Aranmanaippatti	10.191667	78.761111
12023 D	Pudukkottai	Thirumayam	Thirumayam	Peraiyur	10.340278	78.754167
12024 D	Pudukkottai	Thirumayam	Ponnamaravathi	Nagarappatti	10.356944	78.523611
12025 D	Pudukkottai	Thirumayam	Ponnamaravathi	Sevalur	10.294444	78.633333
12026	Pudukkottai	Thirumayam	Ponnamaravathi	Thirukalambur	10.200000	78.498611
12027 D	Pudukkottai	Thirumayam	Thiruvarankulam	Thekkattur	10.298611	78.790278
12028	Pudukkottai	Pudukkottai	Pudukkottai	Mullur	10.420833	78.859722
12029	Pudukkottai	Gandarvakottai	Gandarvakottai	Cholagampatti	10.652778	78.955556
12030	Pudukkottai	Gandarvakottai	Gandarvakottai	Mudukulam	10.618056	79.080556
12031 D	Pudukkottai	Gandarvakottai	Gandarvakottai	Gandarvakottai	10.575000	79.025000
12032 D	Pudukkottai	Alangudi	Thiruvarankulam	Alangudi	10.363889	78.983333
12033 D	Pudukkottai	Alangudi	Karambakudi	Kilangadu	10.563889	79.154167
12034 D	Pudukkottai	Alangudi	Karambakudi	Karuppattipatti	10.484722	79.050000
12035 D	Pudukkottai	Alangudi	Karambakudi	Echanviduthi	10.397222	79.147222
12036 D	Pudukkottai	Gandarvakottai	Gandarvakottai	Vembanpatti	10.541667	79.080556
12037 D	Pudukkottai	Aranthangi	Aranthangi	Melpanaikkadu	10.262500	79.125000
12038 D	Pudukkottai	Avudadayarkoil	Manamelkudi	Manalur	10.048611	79.163889
12039 D	Pudukkottai	Avudadayarkoil	Manamelkudi	Manamelkudi	10.037500	79.233333
12040 D	Pudukkottai	Avudadayarkoil	Manamelkudi	Manamelkudi	10.037500	79.233333
12041 D	Pudukkottai	Alangudi	Karambakudi	Karambakudi	10.455556	79.140278
12042 D	Pudukkottai	Alangudi	Thiruvarankulam	Arayappatti	10.302778	78.969444
12043	Pudukkottai	Manamelkudi	Manamelkudi	Nathanipursakudi	9.9097220	79.141667
12044 D	Pudukkottai	Avudayarkoil	Avudaiyarkovil	Thiyathur	9.9027780	79.079167
12045 D	Pudukkottai	Avudaiyark	Avudaiyarkovil	Madagam	10.054167	78.954167

		oil				
12046 D	Pudukkottai	Aranthangi	Aranthangi	Arsarkulam	10.202778	79.104167
12047 D	Pudukkottai	Pudukkottai	Pudukkottai	Perungalur	10.491667	78.930556
12048	Pudukkottai	Thirumayam	Arimalam	Rayaregunathasamudiram	10.256944	78.765278
12049	Pudukkottai	Kolathur	Kunnandarkovil	Keeranur	10.571944	78.783333
12050	Pudukkottai	Pudukkottai	Pudukkottai	Fcs Pudukkottai	10.376944	78.817500
12051	Pudukkottai	Pudukkottai	Pudukkottai	Manalmelgudi	10.040556	79.232500

(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 developmentis 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)

PUDUKOTTAI 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	PUDUKOTTAI	98,591.79	36,092.10	2,184.25	38,276.35	39	7

Firka Wise Summary

(in ha.m)

PUDUKOTTAI 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**	**Existing Gross Ground Water Draft for All uses (4+5)**	**Stage of Ground Water Development {(6/3)*100} %**	**Category of the Firka**

				water supply			
1	ALANGUDI	2,670.63	1,962.80	64.00	2,026.80	76	SEMI CRITICAL
2	ARANTHANGI	2,306.68	308.00	41.13	349.13	15	SAFE
3	ARASAMALAI	1,680.80	905.00	33.88	938.88	56	SAFE
4	ARASARKULAM	1,726.83	1,324.65	43.10	1,367.75	79	SEMI CRITICAL
5	ATHANI	1,078.84	84.00	342.42	426.42	40	SAFE
6	AVUDAIYARKOIL	3,470.13	22.00	33.54	55.54	2	SAFE
7	EMBAL	3,187.85	240.75	22.08	262.83	8	SAFE

PUDUKOTTAI 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	GANDARVAKOTTAI	2,190.65	517.80	42.62	560.42	26	SAFE
9	ILLUPPUR	2,474.52	816.20	49.17	865.37	35	SAFE
10	KALLAKKOTTAI	2,219.94	1,249.80	40.97	1,290.77	58	SAFE
11	KARAIYUR	1,675.14	1,140.73	49.18	1,189.91	71	SEMI CRITICAL
12	KARAMBAKUDI	2,576.55	1,009.45	61.68	1,071.13	42	SAFE
13	KEELANILAI	3,122.12	645.60	36.32	681.92	22	SAFE
14	KEERAMANGALAM	2,043.06	1,685.20	54.80	1,740.00	85	SEMI CRITICAL
15	KEERANUR	2,049.94	1,010.75	33.97	1,044.72	51	SAFE
16	KILLUKKOTTAI	2,513.44	610.00	33.39	643.39	26	SAFE
17	KODUMBALUR	2,004.08	1,096.40	48.07	1,144.47	57	SAFE
18	KOTTAIPATTINAM	-	-	-	-	--	SALINE
19	KOTTUR	1,112.68	305.80	31.92	337.72	30	SAFE

20	KUDUMIYANMALAI	1,978.53	897.93	53.84	951.76	48	SAFE
21	KUNNANDARKOIL	2,957.17	727.30	51.40	778.70	26	SAFE
22	MALAIYUR	5,765.18	3,429.30	75.85	3,505.15	61	SAFE
23	MANAMELKUDI	3,107.49	186.60	62.93	249.53	8	SAFE
24	MIMISAL	4,040.79	3.00	61.17	64.17	2	SAFE
25	NAGUDI	1,659.27	220.00	36.38	256.38	15	SAFE
26	NARTHAMALAI	1,100.00	705.90	40.59	746.49	68	SAFE
27	NEERPALANI	2,854.08	1,711.45	54.22	1,765.67	62	SAFE
28	PERUMARUTHUR	-	-	-	-	--	SALINE
29	PONNAMARAVATHY	1,650.94	1,016.80	45.75	1,062.55	64	SAFE
30	PONPETTE	3,633.12	-	36.64	36.64	1	SAFE
31	POOVATHAKUDI	2,839.85	625.80	51.24	677.04	24	SAFE
32	PUDUKKOTTAI	1,589.27	622.75	56.21	678.96	43	SAFE
33	PUDUNAGAR	2,793.13	1,823.50	28.07	1,851.57	66	SAFE
34	SENGEERAI	2,873.79	912.40	33.97	946.37	33	SAFE
35	SILATTUR	2,637.76	350.00	85.36	435.36	17	SAFE
36	SINKAVANAM	-	-	-	-	--	SALINE
37	SITHANAVASAL	1,567.74	489.20	20.32	509.52	33	SAFE
38	THIRUMAYAM	2,142.99	149.70	51.58	201.28	9	SAFE
39	VALLANADU	2,010.85	1,220.25	32.87	1,253.12	62	SAFE
40	VARAPPUR	3,140.57	1,951.85	52.06	2,003.91	64	SAFE
41	VEERAPATTY	1,850.17	1,042.30	26.79	1,069.09	58	SAFE
42	VENNAVALKUDI	2,368.13	1,174.70	37.40	1,212.10	51	SAFE
43	VIRACHILAI	1,444.14	20.00	30.43	50.43	3	SAFE
44	VIRALIMALAI	2,482.97	1,876.45	96.98	1,973.43	79	SEMI CRITICAL
TOTAL		**98,591.79**	**36,092.10**	**2,184.25**	**38,276.35**	**39**	

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 Pudukottai 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 13 blocks in Pudukottai District, 13 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 Pudukottai District, totally 44 Firkas, 1 Firkas are categorized as Critical and remaining 43 Firkas are categorized as Semi Critical and Safe blocks and Saline.

  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 2.27%, in the Pudukottai 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 44 Firkas, the total percentage of over exploited and critical Firkas is 2.27%, but, In 2013 assessment, out of 44 Firkas, it has been come down marginally to Nil, in the Pudukottai District.

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- 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 44 Firkas in the District, 5 Firkas are categorized as “Semi Critical Firkas”, 36 Firkas are categorized as “Safe Firkas”, 3 Firkas are categorized as “Saline Firkas”.

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 44 Firkas in the District, 1 Firkas are categorized as “Critical Firkas”, 2 Firkas are categorized as “Semi Critical Firkas”, 38 Firkas are categorized as “Safe Firkas”, 3 Firkas are categorized as “Saline Firkas”.

When compared to last assessment as on March 2011, the “Over Exploited Firkas” remains Nil Firkas, the “Critical Firkas” decreased from 1 to Nil Firkas, the “Semi Critical Firkas” increased marginally from 2 to 5 Firkas, the “Safe Firkas” decreased from 38 to 36 Firkas and the “Saline Firkas” maintains same as 3 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	1	Nil
3	Semi Critical	2	5
4	Safe	38	36
5	Saline	3	3
TOTAL		44	44

(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.