CHAPTER 4.1.9 GROUND WATER RESOURCES

MADURAI DISTRICT

INDEX

GROUND WATER REPORT OF MADURAI 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 Madurai district is 6, 76,685 hectares accounting for 5.2 percent of the total geographical area of Tamil Nadu State. The district has well laid out roads and railway lines connecting all major towns within and outside the state. For administrative purpose, this district has been bifurcated into 9 Taluks and 21 Blocks and 51 Firkas. Madurai is a major city with corporation status.

Madurai District is Totally bifurcated into 51 Firkas.

1. Hydrogelogy

(i) Major Geological formations:

Geology:

Geologically, the entire district can be broadly classified into hard rock and sedimentary (alluvium) formations.

a) Hard rock

More than 90% of the district is underlain by hard rocks. The gneissic type of formation is found on the western portion in the Western Ghats and its offshoots, Cumbum valley, north of Thirumangalam, parts of Melur, etc., Infact, this is the major formation among the various types of hard rocks.

Charnockite occurs as distinct pockets in parts of Periyakulam, Melur, Thirumangalam and Usilampattitaluks. Quartzites which are resistant to weathering are also seen as patches in Charnockite and gneissic varieties.

Valley fill sediments composed of admixtures of calcareous mud, clay, silt and sand occur in several places in the western portion particularly in Uthamapalayam and Usilampattitaluks. Good deposits are found in Cumbum valley, Varshanad valley and near Palakombai. These are the products of quick transportation of weathering material from the adjacent mountain slopes around the valley.

b) Sedimentary (Alluvial) formation

Alluvial deposits such as sand, silt, stiff clay, gravel, etc., which are transported sediments by the river are found on either side of Vaigai near Madurai and Vadipatti blocks. These formations are overlying the hard rock as a thin layer.

Drilling of bore wells:

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 170 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. There is considerable diversity in the nature of formalities even within the short distance. In Uthamapalayamtaluk, there is considerable thickness of valley fill sediments ranging from 30 to 40m below ground level along valley portions. In the reserve forests and the hilly areas, around Periyakulam, Usilampatti and Andipattitaluks, the weathering zone is limited to 20 to 25m below ground level. In the remaining parts of the district, the weathering zone varies from 30 to 40m below ground level. The sedimentary tract of Vaigai alluvium is restricted to either side of the river Vaigai and the thickness of the alluvium is estimated to be around 20 m.

Aquifer parameters:

a) Hard rocks

The thickness of aquifer in this district is highly erratic and varies between 15m and 40m below ground level. The intergranular porosity is essentially dependent upon the intensity and degree of weathering and fracture development in the bed rock. As discussed earlier, deep weathering has developed in gneissic formations and moderate weathering in charnockite formations. The range of aquifer parameters in hard rock regions is given below.

Parameters	**Range**
Well yield in LPM	45-135lpm
Transmissivity (T) m^2/day	15-60 m^2/day
Permeability (K) m/day	0.98-2.45 m/day

b) Valley fill sediments

The boundaries of this deposit are well defined in Theniar sub basin where the thickness varies from 40 to 60m below ground level. In other areas the thickness of valley fill sediments slightly varies between 30 and 40m 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	225-450lpm
Transmissivity (T) m^2/day	75-150 m^2/day
Permeability (K) m/day	1.95-4.40 m/day

c) Alluvium

The alluvium occurs as a linear patch near Madurai city. The range of parameter values for alluvium are furnished below.

Parameters	Range
Well yield in LPM	315-1080lpm
Transmissivity (T) m^2/day	210-1500 m^2/day
Permeability (K) m/day	19.57-48.93 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 Madurai 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 Madurai District, 142 observation wells and 87 piezometers,totally 229 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 Madurai 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 Madurai District. The analysis reveals that the water level has gone down in the north, west and central parts of the Madurai 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 Madurai District.

(iii) Existing network of Monitoring wells:

In Madurai District, the existing network of monitoring wells is 229 wells, 142 wells are observation wells and 87 wells are piezometers. These wells are observed for every month water level.

Madurai District: Observation Wells - Location and Co-ordinates

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
501001	Madurai		Madurai west	Oomachikulam	10°00'18"	78°08'53"
501002	Madurai		Vadipatti	Thanichiyam	10°02'28"	78°00'38"
501003	Madurai		Madurai east	Varichiur	09°54'47"	78°15'04"
501004	Madurai		Madurai east	Sakkudi	09°51'51"	78°13'25"
501005	Madurai		Madurai east	Chithakur	09°56'54"	78°14'37"
501006	Madurai		Madurai east	Poigaikaraipatti	10°02'50"	78°12'10"
501007	Madurai		Madurai east	Velliyankundram	10°01'14"	78°10'42"
501008	Madurai		Thiruparankundram	Chinnaodaipu	09°50'00"	78°06'35"
501009	Madurai		Thiruparankundram	Maravankulam	09°49'53"	78°00'11"
501010	Madurai		Thiruparankundram	Karisalpatti	09°48'07"	77°58'59"
501011	Madurai		Thiruparankundram	Melakuilkudi	09°55'21"	77°02'10"
501012	Madurai		Thiruparankundram	Vilachery	09°54'00"	77°03'34"
501013	Madurai	Melur	Melur	Veppaodappu	09°55'02"	77°18'14"
501014	Madurai	Melur	Melur	Ambalakaranpatti	09°58'20"	77°23'42"
501015	Madurai	Melur	Melur	Kurichipatti	09°58'36"	77°28'53"
501016	Madurai	Melur	Melur	Navinipatti	10°02'38"	78°21'46"
501017	Madurai	Melur	Melur	Keelayur	10°02'50"	78°22'40"
501018	Madurai	Melur	Melur	Manappacheri	10°13'02"	78°21'01"
501019	Madurai	Melur	Melur	Kesampatti	10°09'09"	78°17'59"
501020	Madurai	Melur	Melur	Sennagarampatti	10°04'50"	78°19'13"
501021	Madurai	Melur	Melur	Surakundu	10°02'13"	78°18'54"

501022	Madurai	Melur	Melur	Arittapatti	10°02'31"	78°17'25"
501023	Madurai		Sedapatti	Mangalrevu	09°47'10"	77°47'50"
501024	Madurai		Sedapatti	S.kottaipatti	09°47'38"	77°47'31"
501025	Madurai		Sedapatti	S. Kudipatti	09°48'02"	77°44'28"
501026	Madurai		Sedapatti	Tullukuttinaickanur	09°48'54"	77°41'08"
501027	Madurai		Kallupatti	T. Kunathur	09°44'55"	77°53'16"
501028	Madurai		Kallupatti	Athanur	09°43'30"	77°53'44"
501029	Madurai		Kallupatti	Velampur Chatrapatti	09°40'11"	77°52'14"
501030	Madurai		Kallupatti	Modhagam	09°40'45"	77°48'32"
501031	Madurai		Kallupatti	Vannivelanpatti	09°44'27"	77°50'52"
501032	Madurai		Kallupatti	Salisanthai	09°43'42"	77°48'07"
501033	Madurai		Madurai west	Samayanallur	09°58'51"	77°02'32"
501034	Madurai		Thiruparankundram	Kosavapatti	09°49'12"	77°09'07"
501035	Madurai		Thiruparankundram	Nedunkulam	09°47'14"	77°10'41"
501036	Madurai		Thiruparankundram	Othai Alankulam	09°48'35"	77°03'18"
501037	Madurai		Thiruparankundram	Mykudi	09°47'16"	77°01'00"
501038	Madurai		Kallikudi	Arasapatti	09°45'15"	77°00'23"
501039	Madurai		Kallikudi	Vellakulam	09°42'04"	77°04'11"
501040	Madurai		Kallikudi	Veepankulam	09°41'07"	77°04'03"
501041	Madurai		Kallikudi	Kokkulanchery	09°38'27"	77°58'21"
501042	Madurai		Kallikudi	Thennamanallur	09°40'29"	77°55'23"

501043	Madurai		Kallikudi	Sevarakottai	09°44'41"	77°58'48"
501044	Madurai		Kallikudi	Sengapadai	09°45'44"	77°56'11"
501045	Madurai		Thirumangalam	Soudarpatti	09°48'50"	77°52'52"
501046	Madurai		Chellampatti	Chellampatti	09°56'41"	77°53'41"
501047	Madurai		Usilampatti	Usilampatti	09°57'07"	77°47'22"
501048	Madurai		Usilampatti	Vagurani	09°54'58"	77°48'47"
501049	Madurai		Chellampatti	Vepanuthu	09°53'48"	77°50'32"
501050	Madurai		Usilampatti	Thumalapatti	09°52'10"	77°46'34"
501051	Madurai		Chellampatti	Sadachipatti	09°58'55"	77°51'20"
501052	Madurai		Alanganallur	Achampatti	10°01'40"	78°07'01"
501053	Madurai		Alanganallur	Alagapuri	10°03'23"	78°04'11"
501054	Madurai		Alanganallur	Manickampatti	10°06'16"	78°07'31"
501055	Madurai		Alanganallur	Chatravellalapatti	10°08'53"	78°06'55"
501056	Madurai		Alanganallur	Katchakatti	10°04'58"	77°59'48"
501057	Madurai		Vadipatti	Bodinaickenpatti	10°04'41"	77°57'41"
501058	Madurai		Vadipatti	Kulasekarankottai	10°05'43"	77°57'45"
501059	Madurai		Vadipatti	Mannadimangalam	10°02'31"	77°55'14"
501060	Madurai		Vadipatti	Thiruvalavoyanallur	10°00'29"	78°00'31"
81001 A	Madurai	Madurai South	Thirupparankundram	Kochadai	09°56'33"	78°04'44"
81001 B	Madurai	Madurai south	Thirupparankunram	Kochadai	09°56'37"	78°04'45"
81001B	Madurai	Madurai south	Thiruparankundram	Kochadai	09°56'36"	78°04'39"
83003 A	Madurai	Peraiyur	Sedapatti	Periayur	09°43'38"	77°47'30"
83003 B	Madurai	Peraiyur	Sedapatti	Peraiyur	09°43'53"	77°47'15"

83004	Madurai	Thirumangalam	Kallikudi	Kallikudi	09°42'01"	77°56'41"
83004 A	Madurai	Thirumangalam	Kallikudi	Kallikudi	09°42'05"	77°56'43"
83004 B	Madurai	Thirumangalam	Kallikudi	Kallikudi	09°42'02"	77°56'42"
83005	Madurai	Madurai South	Thiruparankundram	Tiruparankundram	09°52'45"	78°06'47"
83006	Madurai	Thirumangalam	Thirumangalam	Sathangudi	09°50'17"	77°56'15"
83006 A	Madurai	Thirumangalam	Thirumangalam	Santhangudi	09°50'24"	77°56'16"
83007	Madurai	Peraiyur	Sedapatti	Chinnakattalai	09°57'06"	77°47'58"
83007 A	Madurai	Peraiyur	Sedapatti	Chinnakattalai	09°57'07"	77°48'02"
83007B	Madurai	Peraiyur	Sedapatti	Chinnakattalai	09°57'07"	77°48'02"
83008	Madurai	Peraiyur	Sedapatti	Elumalai	09°51'40"	77°42'04"
83013	Madurai	Usilampatti	Usilampatti Municipality	Usilamaptti	09°57'53"	77°47'26"
83014	Madurai	Vadipatti	Vadipatti	Thiruvedagam	10°01'08"	77°57'48"
83014 B	Madurai	Vadippatti	Vadippatti	Thiruvedagam	09°59'21"	77°59'20"
83014 A	Madurai	Vadipatti	Vadipatti	Thiruvedagam	10°01'12"	77°57'51"
83014A	Madurai	Vadippatti	Vadippatti	Thatchampathu	09°59'50"	77°59'17"
83014B	Madurai	Vadipatti	Vadipatti	Mullipallam	10°01'08"	77°57'04"
83016	Madurai	Melur	Melur	Chittampatti	09°58'53"	78°14'09"
83016 A	Madurai	Melur	Melur	Chittampatti	09°58'47"	78°14'04"
83017	Madurai	Melur	Melur	Palayur	09°57'08"	78°18'35"
83018	Madurai	Melur	Kottampatti	Karungalakudi	10°09'35"	78°22'09"
83018 A	Madurai	Melur	Kottampatti	Karungalakudi	10°09'42"	78°21'59"
83018A	Madurai	Melur	Melur	Karunkalakudi	10°37'59"	78°21'53"
83020	Madurai	Vadippatti	Alanganallur	Valayapatti	10°09'28"	78°06'58"

83020A	Madurai	Vadipatti	Alanganallur	Valayapatti	10°08'52"	78°07'12"
83025	Madurai	Madurai south	Thiruparankundram	Keelamathur	09°57'48"	78°01'56"
83025 A	Madurai	Madurai South	Thirupparankundram	Keelamathur	09°57'47"	78°02'06"
83027	Madurai	Madurai South	Madurai East	Viraganur	09°52'38"	78°11'12"
83027 A	Madurai	Madurai south	Madurai east	Viraganur	09°54'03"	78°09'46"
83027A	Madurai	Madurai south	Madurai east	Viragnur	09°52'58"	78°11'01"
83047	Madurai	Peraiyur	T.Kallupatti	Subbulapuram	09°40'37"	77°48'39"
83048	Madurai	Thirumangalam	Kallikudi	Puliankulam (M)	09°39'33"	77°54'37"
83049	Madurai	Thirumangalam	Kallikudi	Peikulam	09°38'43"	77°58'29"
83050	Madurai	Thirumangalam	Kallikudi	Maruthangudi	09°41'29"	77°02'31"
83051	Madurai	Peraiyur	T.Kallupatti	Karaikeni	09°42'38"	77°53'10"
83052	Madurai	Peraiyur	Sedapatti	Saptur	09°45'32"	77°44'33"
83055	Madurai	Peraiyur	Sedapatti	Mallapurram	09°48'22"	77°40'12"
83056	Madurai	Peraiyur	Sedapatti	Athipatti	09°47'38"	77°44'01"
83057	Madurai	Peraiyur	Sedapatti	Mangalarevu	09°47'29"	77°48'33"
83057 A	Madurai	Peraiyur	Sedapatti	Viralampatti	09°47'32"	77°48'30"
83058	Madurai	Thirumangalam	Thirumangalam	Alappalacheri	09°47'36"	77°52'42"
83058 A	Madurai	Thirumangalam	Thirumangalam	Sithireddipatti	09°47'31"	77°52'34"
83059	Madurai	Thirumangalam	Thirumangalam	Sengapadai	09°46'51"	77°57'04"
83060	Madurai	Thirumangalam	Thirumangalam	Chinna Ulagani	09°46'35"	78°02'33"
83061	Madurai	Madurai South	Thiruparankundram	Eliyarpatti	09°47'43"	78°05'41"
83062A	Madurai	Thirumangalam	Thirumangalam	Kappalur	09°51'31"	78°01'23"
83063	Madurai	Thirumangalam	Thirumangalam	Tangalacheri	09°50'04"	77°52'13"

83064	Madurai	Peraiyur	Sedapatti	Thirumanickam	09°50'56"	77°45'02"
83065A	Madurai	Peraiyur	Sedapatti	Ulaipatti	09°50'16"	77°41'00"
83071	Madurai	Usilampatti	Usilampatti	Doddappanaickanur	09°58'34"	77°42'53"
83072	Madurai	Usilampatti	Usilampatti	Valandur	09°56'59"	77°52'19"
83072 A	Madurai	Usilampatti	Usilampatti	Valandhur	09°57'10"	77°52'13"
83072A	Madurai	Usilampatti	Usilampatti	Valandur	09°56'59"	77°52'19"
83073	Madurai	Thirumangalam	Thirumangalam	Chokkanathapuram	09°56'24"	77°58'29"
83073 A	Madurai	Thirumangalam	Thirumangalam	Chekkanurani	09°56'22"	77°58'10"
83073A	Madurai	Thirumangalam	Thirumangalam	Chekkanurani	09°56'24"	77°58'29"
83075	Madurai	Madurai South	Madurai East	Thatchanendal	09°55'49"	78°10'48"
83076	Madurai	Madurai south	Madurai East	Varichiyur	09°54'19"	78°15'14"
83077	Madurai	Melur	Melur	Uranganpatti	09°59'50"	78°25'44"
83077A	Madurai	Melur	Melur	Uranganpatti	09°59'52"	78°25'48"
83078	Madurai	Melur	Kottampatti	Melapadinethamkudi	09°59'38"	78°19'51"
83079	Madurai	Madurai North	Madurai East	Koolapandi	10°00'27"	78°08'42"
83080	Madurai	Vadipatti	Alanganallur	Nagari	10°01'02"	78°01'06"
83080 A	Madurai	Vadippatti	Alanganallur	Nagari	10°01'10"	78°00'59"
83081	Madurai	Usilampatti	Chellampatti	Vikramangalam	10°01'19"	77°53'14"
83081 A	Madurai	Usilampatti	Chellampatti	Melaperumalpatti	10°01'18"	77°53'25"
83082	Madurai	Usilampatti	Usilampatti	Uthappanaickanur	10°02'02"	77°47'35"
83092AY	Madurai	Vadipatti	Vadipatti	Vadipatti	10°03'09"	77°58'32"
83093A	Madurai	Vadipatti	Alanganallur	Ayyur	10°04'14"	78°05'00"
83094B	Madurai	Vadippatti	Alanganallur	Thevaseri	10°04'23"	78°06'56"
83095	Madurai	Melur	Kottampatti	Pulipatti	10°05'05"	78°17'19"

83096	Madurai	Melur	Kottampatti	Thumbaipatti	10°05'07"	78°21'35"
83097	Madurai	Melur	Melur	Pallakudi	10°05'03"	78°27'03"
83098	Madurai	Melur	Melur	Samutrapatti	10°09'30"	78°18'00"
83099	Madurai	Madurai North	Madurai East	Kadavur	10°04'37"	78°10'30"
83506	Madurai	Melur	Kottampatti	Kottampatti	10°13'20"	78°22'28"
83507	Madurai	Melur	Kottampatti	Pottapatti	10°16'47"	78°22'22"
83507A	Madurai	Melur	Melur	Pottapatti	10°16'52"	78°22'10"

Madurai District - Piezometers - Location and Co-ordinates

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
AWLR - MWS 2	Madurai	Madurai south		Keelamathur	9.963333	78.032222
AWLR 81083	Madurai	Vadippatti		Vadipatty	10.08	77.964444
AWLR 81220	Madurai	Madurai south		Valayankulam	9.797222	78.1
21001D	Madurai	Madurai South	Thirupparankundram	Thirupparankundram	9.881667	78.11
21002D	Madurai	Thirumangalam	Thirumangalam	Chokkanathapuram	9.941944	77.969444
21003D	Madurai	Peraiyur	Sedapatti	Chinnakattalai	9.844167	77.799722
21004D	Madurai	Thirumangalam	Thirumangalam	Chinna ulagani	9.770556	78.053611
21005D	Madurai	Madurai South	Thirupparankundram	Eliyarpatti	9.794722	78.095
21006D	Madurai	Peraiyur	Sedapatti	Elumalai RF	9.865278	77.711667
21007D	Madurai	Thirumangalam	Kallikudi	Kallikudi	9.685278	77.975556
21008D	Madurai	Madurai South	Thirupparankundram	Melamathur	9.965	78.018333
21009A	Madurai	Thirumangalam	Thirumangalam	Utchapatti	9.856667	78.009444
21009D	Madurai	Thirumangalam	Thirumangalam	Kappalur	9.856944	78.019167
21010D	Madurai	Madurai North	Madurai East	Karupayoorani	9.930556	78.18
21011D	Madurai	Peraiyur	Sedapatti	Mallapuram	9.805833	77.669444
21012D	Madurai	Thirumangalam	Kallikudi	Kurayur	9.690556	78.024722
21013D	Madurai	Vadippatti	Alanganallur	Manianji	10.006389	78.094444
21014D	Madurai	Madurai South	Thirupparankundram	Kilakuyilkudi	9.930833	78.046944
21015D	Madurai	Peraiyur	T.Kallupatti	Peraiyur	9.733611	77.791389
21016D	Madurai	Peraiyur	T.Kallupatti	Subbulapuram	9.673889	77.810556
21017D	Madurai	Thirumangalam	Thirumangalam	Thangalacheri	9.835833	77.868611
21018D	Madurai	Thirumangalam	Kallikudi	Peikulam	9.645278	77.997222
21019D	Madurai	Melur	Kottampatti	Karungalakudi	10.158333	78.364167
21020D	Madurai	Melur	Kottampatti	Pallapatti	10.249444	78.386111

21021D	Madurai	Melur	Kottampatti	Attapatti	10.0825	78.3875
21022D	Madurai	Melur	Melur	Pulipatti	10.083889	78.288611
21023D	Madurai	Melur	Melur	Uranganpatti	9.992778	78.431111
21024D	Madurai	Melur	Melur	Thiruvadur	9.956667	78.3175
21025D	Madurai	Madurai North	Madurai East	Varichiyur	9.910278	78.256667
21026D	Madurai	Vadippatti	Alanganallur	Senthamangalam	10.136111	78.145
21027D	Madurai	Vadippatti	Vadipatti	Thiruvedagam	10.017778	77.974167
21028D	Madurai	Usilampatti	Chellampatti	Veppanuthu	9.898889	77.840833
21029D	Madurai	Usilampatti	Chellampatti	Vikkiramangalam	10.022222	77.022222
21030D	Madurai	Peraiyur	T.Kallupatti	Kunnathur	9.7425	77.898611
21031D	Madurai	Usilampatti	Usilampatti	Uthappanaickanur	10.0325	77.792778
21032D	Madurai	Usilampatti	Usilampatti	Doddappanaickanur	9.971667	77.735833
21033D	Madurai	Usilampatti	Usilampatti	Usilampatti	9.959167	77.790278
21034D	Madurai	Melur	Melur	Chittampatti	9.984167	78.240278
21035D	Madurai	Madurai North	Madurai West	Madurai North	9.931667	78.133611
21036D	Madurai	Madurai North	Madurai West	Koolapandi	10.011111	78.145833
21037D	Madurai	Thirumangalam	Thirumangalam	Kandai	9.870556	77.913333
21038D	Madurai	Vadippatti	Alanganallur	Saranthangi	10.100556	78.151944
Ex 21070	Madurai	Melur	Melur	Sunnambur	9.878611	78.291111
Ex-21039	Madurai	Usilampatti	Usilampatti	K.Nattarpatti	9.968889	77.863611
Ex-21040	Madurai	Peraiyur	T.kallupatti	T.kallupatti	9.715833	77.859444
Ex-21041	Madurai	Peraiyur	Sedapatti	Sedapatti	9.826389	77.8
Ex-21042	Madurai	Peraiyur	T.kallupatti	Saptur	9.764722	77.740278
Ex-21071	Madurai	Melur	Kottampatti	Pottapatty	10.281944	78.370556
Ex-21072	Madurai	Melur	Kottampatty	Surapatty	10.301111	78.386944
Ex-21073	Madurai	Melur	Kottampatty	Kunnarampatty	10.201667	78.319444
EX-22095	Madurai	Melur	Melur	Sunnamboor	9.878611	78.291111
HP 21074	Madurai	Madurai north	Madurai west	Chettikulam	9.995	78.146944
HP 21075	Madurai	Madurai north	Madurai west	Chathrapatti	10.03	78.15
HP 21076	Madurai	Madurai north	Madurai west	Vayalur	10.018333	78.053889
HP 21077	Madurai	Madurai north	Madurai east	Elanthgiyendal	9.949722	78.230833
HP 21078	Madurai	Madurai north	Madurai east	Kalikappan	9.939444	78.193611
HP 21079	Madurai	Madurai north	Madurai east	Rajakkoor	9.928611	78.238333
HP 21080	Madurai	Madurai north	Madurai east	Kalimangalam	9.878333	78.238889
HP 21081	Madurai	Madurai north	Madurai east	Elamanur	9.900556	78.210833
HP 21082	Madurai	Madurai south	Thirupparankundram	Nallur	9.788333	78.133333
HP 21083	Madurai	Madurai south	Thirupparankundram	Nilaiyur	9.855556	78.059167
HP 21084	Madurai	Madurai south	Thirupparankundram	Sakkilipatti	9.901389	78.011111
HP21068	Madurai	Vadippatti	Alanganallur	Alanganallur	10.048333	78.083889
HP21069	Madurai	Vadippatti	Alanganallur	Muduvarpatti	10.080278	78.124722
MWS21043	Madurai	Usilampatti	Chellampatti	Pullaneri	9.9325	77.946667
MWS21044	Madurai	Usilampatti	Chellampatti	Sangampatti	9.948333	77.898333
MWS21045	Madurai	Usilampatti	Chellampatti	Prouppumettupatti	9.904722	77.880833
MWS21053	Madurai	Peraiyur	T.Kallupatti	Karaikeni	9.704722	77.862222
MWS21054	Madurai	Thirumangalam	Kallikudi	Swamimallampatti	9.756944	77.954167

MWS21055	Madurai	Thirumangalam	Kallikudi	Thumbakulam Pudur	9.751667	78.045833
MWS21056	Madurai	Usilampatti	Usilampatti	Meikkilarpatti	9.980556	77.802778
MWS21057	Madurai	Usilampatti	Chellampatti	Panamoopanpatti	10.053889	77.529167
MWS21058	Madurai	Usilampatti	Chellampatti	Poduvarpatti	9.9975	77.862778
MWS21059	Madurai	Vadippatti	Vadipatti	Kaupatti	10.022222	77.92
MWS21067	Madurai	Melur	Kottampatti	Veerasudamanipatti	10.139722	78.348333
MWS21046	Madurai	Peraiyur	Sedapatti	Perunkamanallur	9.862778	77.818056
MWS21047	Madurai	Usilampatti	Usilampatti	M.Rajakkapatti	9.883889	77.768611
MWS21048	Madurai	Peraiyur	Sedapatti	Pappinaickenpatti	9.820278	77.711111
MWS21049	Madurai	Peraiyur	Sedapatti	Thottanampatti	9.791389	77.783333
MWS21050	Madurai	Thirumangalam	Thirumangalam	Mathipanur	9.795556	77.8375
MWS21051	Madurai	Thirumangalam	Thriumangalam	S.meenakshipuram	9.811944	77.885278
MWS21052	Madurai	Peraiyur	T.Kallupatti	Muthunagayapuram	9.771389	77.812222
MWS21060	Madurai	Vadippatti	Vadipatti	Karattupatti	10.084167	77.991667
MWS21061	Madurai	Vadippatti	Vadipatti	Thathampatti	10.022222	78.015556
MWS21062	Madurai	Vadippatti	Alanganallur	Periyalanthaikulam	10.068333	78.051389
MWS21063	Madurai	Madurai north	Madurai west	Erukalnatham	10.014722	78.173889
MWS21064	Madurai	Madurai north	Thirupparankundram	Nedunkulam	9.786111	78.179722
MWS21065	Madurai	Madurai north	Madurai east	Mangulam	10.049167	78.25
MWS21066	Madurai	Melur	Melur	Attukulam	10.0025	78.356667

(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

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

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)

MADURAI 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	MADURAI	63,797.96	39,040.31	4,010.38	43,050.69	67	5

Firka Wise Summary

(in ha.m)

MADURAI 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.VELLALAPATTI	1,667.44	547.60	1,342.81	1,890.41	113	OVER EXPLOITED
2	ALANGANALLUR	1,168.47	536.00	195.09	731.09	63	SAFE
3	APPAN THIRUPATHI	626.22	148.00	26.52	174.52	28	SAFE
4	ARUMABANUR	788.20	188.10	44.78	232.88	30	SAFE
5	ATHIPATTI	1,677.62	1,259.82	26.47	1,286.29	77	SEMI CRITICAL
6	AVANIYAPURAM	763.31	227.70	52.28	279.98	37	SAFE
7	CHATHRAPATTI	1,030.01	406.40	35.26	441.66	43	SAFE

MADURAI 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	ELUMALAI	1,823.63	1,493.35	48.17	1,541.52	85	SEMI CRITICAL
9	KALLANDHIRI	1,005.03	378.40	30.53	408.93	41	SAFE
10	KALLIGUDI	1,149.51	631.20	306.63	937.83	82	SEMI CRITICAL
11	KARUMATHUR	2,443.26	1,986.15	72.72	2,058.87	84	SEMI CRITICAL
12	KARUNGALAKUDI	2,291.22	907.20	45.59	952.79	42	SAFE
13	KEELAVALAVU	1,828.92	593.20	54.74	647.94	35	SAFE
14	KOKKULAM	1,843.18	1,692.34	70.65	1,762.99	96	CRITICAL
15	KOOLAPANDI	457.53	161.25	35.81	197.06	43	SAFE
16	KOTTAMPATTI	1,581.59	1,462.50	65.06	1,527.56	97	CRITICAL
17	KULAMANGALAM	1,328.21	403.00	34.78	437.78	33	SAFE
18	KUNNATHUR	1,295.15	273.00	21.08	294.08	23	SAFE
19	KURAIYUR	1,244.49	623.75	13.38	637.13	51	SAFE
20	MADURAI EAST	217.71	144.80	34.64	179.44	82	SEMI CRITICAL
21	MADURAI WEST	230.06	209.00	3.99	212.99	93	CRITICAL
22	MELAVALAVU	1,755.08	745.50	47.54	793.04	45	SAFE
23	MELUR	1,786.00	698.22	313.49	1,011.71	57	SAFE
24	MOTHAGAM	851.11	459.20	26.80	486.00	57	SAFE
25	MUDUVARPATTI	803.56	1,161.93	38.02	1,199.95	149	OVER EXPLOITED
26	NAGAMALALI PUDUKOTTA	871.76	621.27	139.10	760.37	87	SEMI CRITICAL
27	NEERATHAN	1,358.55	972.92	25.07	997.98	73	SEMI CRITICAL
28	OTHAKKADAI	604.58	176.26	20.72	196.98	33	SAFE
29	PALAMEDU	856.23	1,066.60	27.69	1,094.29	128	OVER EXPLOITED
30	PANNIKKUNDU	1,752.74	1,233.13	46.89	1,280.02	73	SEMI CRITICAL

31	PERAIYUR	1,419.18	987.05	47.21	1,034.26	73	SEMI CRITICAL
32	RAJAKKUR	711.63	171.00	9.32	180.32	25	SAFE
33	SAKKIMANGALAM	974.66	129.00	30.85	159.85	16	SAFE
34	SAMAYANALLUR	1,533.66	417.20	43.91	461.11	30	SAFE
35	SATHAMANGALAM	317.88	29.25	20.91	50.16	16	SAFE
36	SEDAPATTI	1,181.63	1,080.25	30.47	1,110.72	94	CRITICAL
37	SINDHUPATTI	1,977.72	1,793.70	48.50	1,842.20	93	CRITICAL
38	SIVARAKKOTTAI	1,133.84	717.10	31.47	748.57	66	SAFE
39	SOLAVANDHAN	1,086.28	735.60	10.96	746.56	69	SAFE
40	T.KALLUPATTI	913.60	422.00	37.60	459.60	50	SAFE
41	THANICHIAM	1,000.62	532.40	31.88	564.28	56	SAFE
42	THENKARAI	1,906.08	1,435.28	69.68	1,504.95	79	SEMI CRITICAL
43	THIRUMANGALAM	1,102.21	934.42	36.27	970.68	88	SEMI CRITICAL
44	THIRUPPARAN KUNDRAM	1,081.97	663.75	76.08	739.83	68	SAFE
45	THIRUVATHAVUR	1,967.03	697.02	30.76	727.78	37	SAFE
46	USILAMPATTI	1,987.34	2,140.63	48.06	2,188.68	110	OVER EXPLOITED
47	UTHAPPANAICKANUR	1,012.04	1,028.90	30.83	1,059.73	105	OVER EXPLOITED
48	VALANTHUR	2,069.45	1,535.05	35.08	1,570.13	76	SEMI CRITICAL
49	VALAYANKULAM	657.91	409.95	29.08	439.03	67	SAFE
50	VELLALUR	1,941.92	1,476.00	51.31	1,527.31	79	SEMI CRITICAL
51	VIRATHANUR	720.93	297.00	13.84	310.84	43	SAFE
TOTAL		**63,797.96**	**39,040.31**	**4,010.38**	**43,050.69**	**67**	

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 Madurai 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 Madurai District, 6 blocks are categorized as Over Exploited and Critical blocks and remaining 7 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 Madurai District, totally 51 Firkas, 5 Firkas are categorized as Over Exploited and remaining 46 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 46.15%, but, the total percentage of over exploited and critical Firkas as on March 2011 Assessment is 9.80%, in the Madurai 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 51 Firkas, the total percentage of over exploited and critical Firkas is 9.80%, but, In 2013 assessment, out of 51 Firkas, it has been come down marginally to 19.60%, in the Madurai 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 51 Firkas in the District, 5 Firkas are categorized as “Over Exploited Firkas”, 5 Firkas are categorized as “Critical Firkas”, 13 Firkas are categorized as “Semi Critical Firkas”, 28 Firkas are categorized as “Safe Firkas”.

  Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 51 Firkas in the District, 4 Firkas are categorized as “Over Exploited Firkas”, 1 Firkas are categorized as “Critical Firkas”, 13 Firkas are categorized as “Semi Critical Firkas”, 33 Firkas are categorized as “Safe Firkas”.

  When compared to last assessment as on March 2011, the “Over Exploited Firkas” increased from 4 to 5 Firkas, the “Critical Firkas” increased from 1 to 5 Firkas, the “Semi Critical Firkas” maintains the same as 13 Firkas, the “Safe Firkas” decreased from 33 to 28 Firkas and the “Saline Firkas” remains Nil Firkas. The alteration of Firkas are due to the construction of Artificial Recharge structures such as Check Dams, Recharge Wells, Recharge shafts, percolation ponds; etc was constructed in the “Over Exploited Firkas” by various departments.

S.No	Categorisation	No of Firkas	
		2011	2013
1	Over Exploited	4	5
2	Critical	1	5
3	Semi Critical	13	13
4	Safe	33	28
5	Saline	Nil	Nil
TOTAL		51	51

(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.