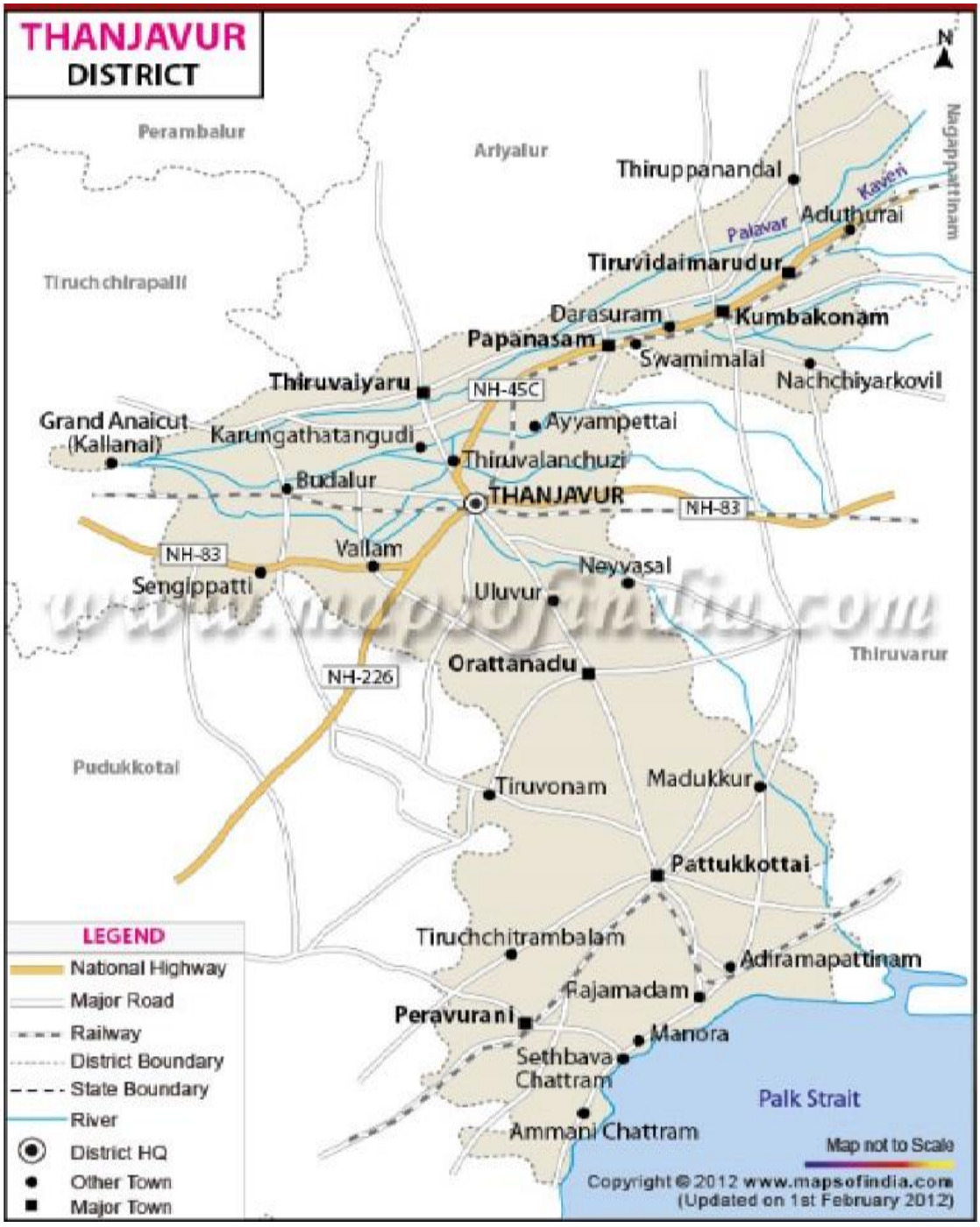
DISTRICT SURVEY REPORT FOR GRAVEL
THANJAVUR DISTRICT
TAMILNADU STATE

(Prepared as per Gazette Notification S.O.3611 (E) dated 25.07.2018 of Ministry of Environment, Forest and Climate Change)



MAY 2019

1. Introduction

In pursuance to the Gazette Notification, Ministry of Environment, Forest and Climate Change, the **Government of India Notification No. S.O.3611 (E) dated 25.07.2018** laid procedure for preparation of District Survey Report of Minor minerals other than sand mining or river bed mining. The main purpose of preparation of District Survey Report is to identify the mineral resources and developing the mining activities along with other relevant data of the District.

2. Overview of Mining Activity

No Minerals of Economic Importance found in Thanjavur District, except Gravel, Laterite, Red Soil, Brown Clay, filling Earth and sand. Gravel, Red Soil and Filling Earth are used as filling material in construction works. Brown clay is quarried and used in Country kiln and Chamber Kiln for making of Bricks.

Mainly two type of Minor Minerals constituents such as sand and gravel are required for any type of construction apart from other material like cement and steel. In earlier times, the houses / buildings were constructed in the form of small dwellings with walls made up of mud plaster, stone, and interlocking provided with wooden frames and there were **negligible** commercial as well as developmental activities resulting in less demand of binding materiel. Now a days, new vistas of development activities are started and increase the consumption of Minor Mineral such as sand, Gravel, filling Earth etc. Tamilnadu State is highly urbanized state in Indian sub continent after Maharashtra, the demand of minor mineral in the Thanjavur District has started increasing trend.

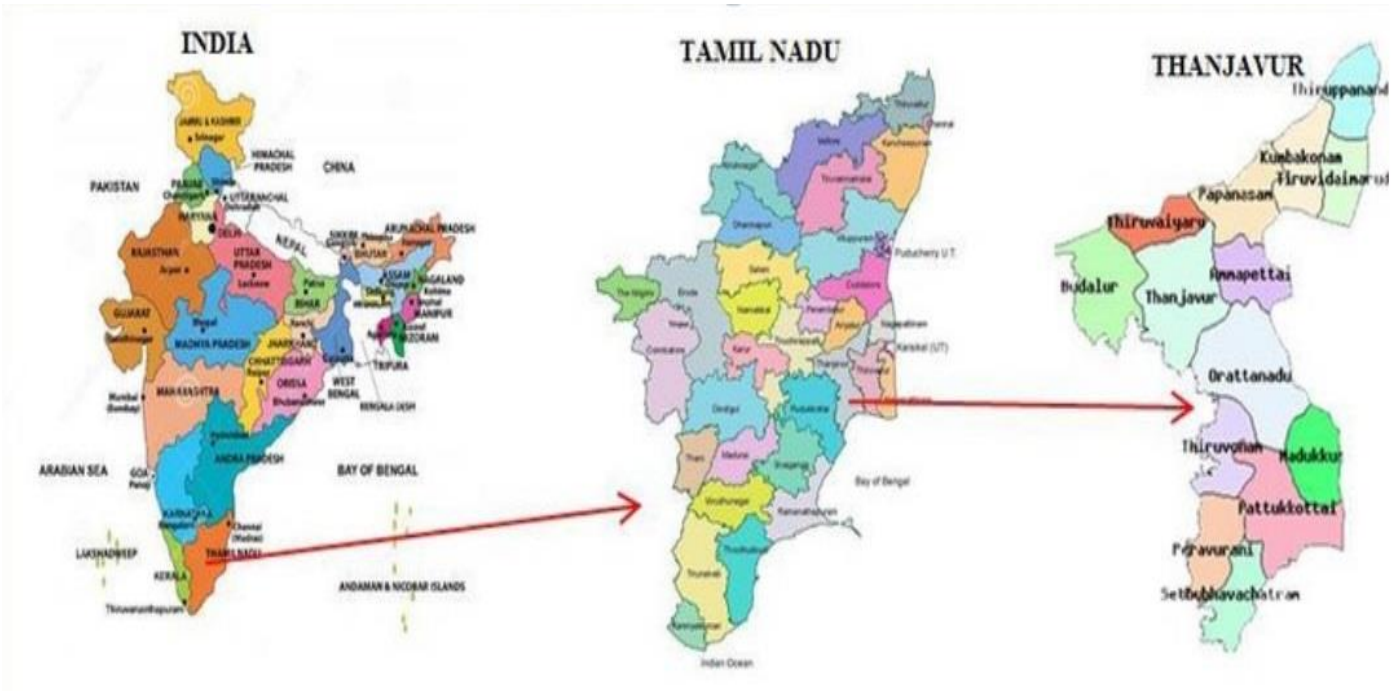
The office of the Assistant Director, Department of Geology and Mining is functioning under the control of District Collector, Thanajvur. The Assistant Director, Geology and Mining supports the District Collector in the Mineral Administration works.

3. General Profile of the District

Thanajvur District is Rice Bowl of TamilNadu state. It is bounded on the north by Ariyalur and Nagapattinam District, South by Pudukottai District, East by Thiruvarur and west by Tiruchirapalli and Ariyalur District. Thanjavur District consist of Three Revenue Divisions viz, Thanjavur, Kumbakonam and Pattukottai, Nine Taluks viz, Thanjavur, Budalur, Thiruvaiyaru, Papanasam, Kumbakonam, Thiruvidaimarudur, Orathanadu, Pattukottai and Peravurani. Thanjavur District has 50 Firkas and 906 Revenue villages.

The District has fourteen blocks viz, Ammapettai, Budalur. Kumbakonam, Madukkur, Orathanadu, Papanasam, Pattukottai, Peravurani, Sethubavachatram, Thanjavur, Thirupananthal, Thiruvaiyaru, Thiruvidaimarudur and Thiruvonam. The District has 589 Panchayat villages.

The District has one Corporation, 2 Municipalities and 22 Town panchayats and also has One Parlimentary constituencies and 8 Assembly constituencies.



THANJAVUR DISTRICT MAP

3.1 Location

Thanjavur District is Located in Eastern side of Central Tamil Nadu and District lies between 9^0 50' 00" N to 11^0 25' 00" N and 70^0 23' 00" E to 78^0 43' 00" E. Thanjavur Railway station connected by southern railway which connects Chennai, Madurai, Tuticorin and Thirunelveli, Nagapattinam, Thiruvarur , Trichy, Salam, Erode, Coimbatore. Thanjavur is also well connected by Roadways, which is also important road junction on Thanjavur– Ariyalur, Thanjavur – Chidambaram, Thanjavur – Nagapattinam, Thanajvur – Ramanathapuram, Thanjavur – Madurai, Thanajvur – Trichy. Important National Highways are 1. NH-36 – Vikravandi-Thanjavur-Manamadurai, 2. NH-83 – Coimbatore- Thanjavur – Nagapattinam. Important State Highways are

1. SH-8 ---Vikravandi – Kumbakonam – Thanajvur.
2. SH-29 --Thanjavur – Kararikudi – Sayalkudi.
3. SH-63 -- Thanajvur – Thiruthuraipoondi – Kodiakkarai.
4. SH-66 -- Kumbakonam –Mannargudi – Adirampattinam.
5. SH-99 -- Thirukkattupalli – Sengipatti – Pattukottai.
6. SH-99A -- Thanjavur – Vallam.
7. SH-146 -- Mannargudi – Pattukottai – Sethubavachadram.
8. SH-147 -- Kumbakonam - karaikal.

3.2 Area and Population

Thanjavur District, Totally covering an area of 3396.57 Sq kms. As per 2011 census, Thanjavur had population of 24,05,890, in which Male and Female were 11,82,416 and 12,23,474 respectively . In 2001 census, Thanjavur had population of 22,16,138, in which Male and Female were 10,96,638 and 11,19,500 respectively. There is a increase of 8.56 percent in the population compared to population as per 2001.

3.3 Administrative set - up

Thanjavur District consist of Three Revenue Divisions viz, Thanjavur, Kumbakonam and Pattukottai, Nine Taluks viz, Thanjavur, Budalur,

Thiruvaiyaru, Papanasam, Kumbakonam, Thiruvidaimarudur, Orathanadu, Pattukottai and Peravurani. Thanjavur District has 50 Firkas, 906 Revenue villages.

The District has fourteen blocks viz, Ammapettai, Budalur. Kumbakonam, Madukkur, Orathanadu, Papanasam, Pattukottai, Peravurani, Sethubavachatram, Thanjavur, Thirupananthal, Thiruvaiyaru, Thiruvidaimarudur and Thiruvonam. The District has 589 Panchayat villages. The District has one Corporation, 2 Municipalities and 22 Town panchayats.

3.4 Agricultural Resources and Irrigation

Agriculture continues to be the most predominant sector of this district economy and Thanjavur being the foremost district of the Cauvery delta and occupies an important position in the agricultural map of Tamilnadu, 70% population is engaged in Agricultural and allied activities of their livelihood. The District has a Geographical area of 3.39 Lakhs Ha with a gross cropped area of around 2.69 Lakhs Ha. Since It's formation , the district is called as the "Rice bowl of Tamilnadu". Thanjavur has all along been one of the District with a creditable performance in Agricultural production with the farmers relatively more responsive and receptive to new technologies. They also innovative in adapting modern Technologies and High yielding varieties.

3.5 Trade and Commerce

Thanjavur District is one of the 13 coasted District in Tamilnadu, which produces 5% of the Total production of sea foods . The other things that are famous in this district are ancient **Handicrafts**, Bronze coins, Art plates, Bell metal castings, Bowls, Napkin, Powder boxes and Painting. Apart from these, Ornamental fans, mats, Musical instruments out of jack wood, and Handloom silks and also cotton sarees. Finally to conclude, no one can deny the fact that the unique doll made in Thanjavur is something special which nods its head in air.

Market committees are functioning in the district for the purchase and sale of cotton, groundnut, chilly, corn and other edible oil products.

The Co-operative Societies for milk are functioning at all parts of the District.

4. Geology of the District

Archaean Formation

Small exposures of Archaean rocks, also known as basement of crystalline rocks are seen in the western part of the area near Sengipatti village. They consist mainly of gneisses, schists, granites and charnockites, intruded at places by pegmatite veins. The rocks are weathered mantle ranges in thickness between 10 and 12m. They exhibit well developed 2 directional joints. The general trend of Foliation of this formation is Northeast Southwest with steep easterly dip. In the sub-stratum in the delta of the district, the basement rocks were encountered only in the upstream in the delta of the district, the basement in the central part of the delta is estimated between 3000 and 4000 meters.

Cretaceous Formation

The cretaceous formation occurs in a narrow belt adjacent to the Archaean basement near Vallam. They overlie the faulted Archaen basement rock. They consist mainly of reddish and yellowish calcareous sandstone. The formation is deposited in marine environment and is fossiliferous.

Tertiary Formation

The Eocene formations do not crop out anywhere in the district. They are encountered in the bore holes drilled by the board and other agencies at depths of about 130m in the western part and about 450m in the central and eastern parts of the district. The formation included integrated beds of silts, clays, shale's, sandy clays and occasionally lime stones which were deposited in a wedge like structure with its thickest end towards the sea. In the western part of the district in the area around Orathanadu and further north, these formations are more sandy in nature indicating fluvial to littoral condition of deposition. But towards the eastern

part of the area, the formation becomes, much finer with increasing proportion of clay and shale intercalation.

The Exposures of the formation of Miocene age are found near west of Grand Anaicut Canal in Thanjavur taluk overlying the older cretaceous formation. The formation consists mainly friable, variegated course (white, gray, and green) to fine- grained clay- bound sandstone with gravel. The thickness of these formations ranges from less than a meter in the west to about 600 m in the east. On the basis of faunal evidences, the Miocene formation was classified into lower Miocene as the one unit, and upper and middle Miocene as the second unit. The second unit of upper and middle Miocene deposits consist clay-bound fine sands. There is no out crop of the second unit. Their thickness increases from West to East from 0 to 180 m. The lower Miocene unit contains two distinct Zones namely the Burdigalain and the Aquitanian (the lower zone). The out crop of Aquitanian zone consists of the sandy and gravely deposits typical of deltaic facies and a similar formation occur in the area west of line joining the Okkanadu-kilayur and Ottangadu. The Cauvery and vennar sub-basins in the eastern part of the above area is mainly composed of clay and clay-bound sands. The thickness of Aquitanian deposits increases from 33m near Thanjavur in the west to about 120m along the coast where the deposits occur at depths varying from 420 to 540m below land surface. The out crop of the Burdigalain the upper zone.

The Pliocene The exposures of Pliocene exists in the whole of new delta area and a small area west of Grand Anaicut canal covering whole of Pattuottai, Peravurani, Orathanadu. The main lithological units are sands, and sandy clay with gravel beds. They form a flat terrain marked by a net of wide, shallow and long depressions, which are the remnants of the old drainage. Most of the area is blanketed by reworked lateritic gravel which in turn, is overlain by the windblown grey sands.

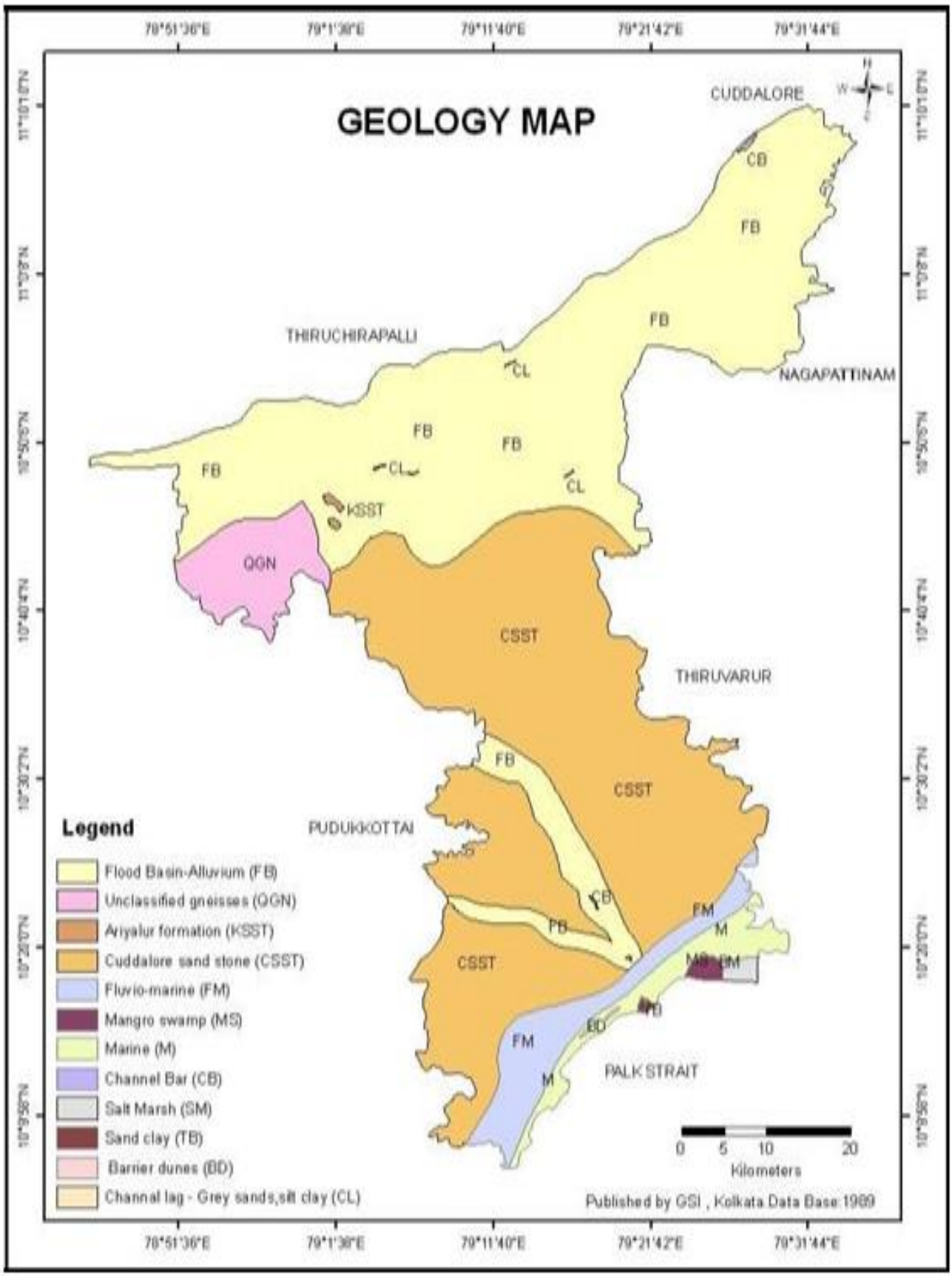
Quaternary Formation

The formation of this group occupies the entire Cauvery sub basin and almost the whole of Vennar sub-basin. They are fluvial and semi-

marine in origin. The thickness of the fluvial deposit is about 12m at Grant Anaicut at the western end of the easterly direction to about 40m near the coast. The sandy silts of 3 to 6m thickness on the top partly confine the coarser deposit beneath. The semi-marine sandy clay deposits of the Vennar sub-basin are about 50m in thickness near the coast. Quaternary deposits are confined to the coastal area and flood plains of major rivers.

The Quaternary sediments are expected to have been resulted from the erosive action of various natural agents like wind and river. The sediments consist of clay, silt and sand.

The sedimentation has taken place under fluvial, fluvial-marine, and Alluvial environments. As a result, typical deltaic and coastal landforms with distinct differences in composition, leading to the recognition of various morpho-stratigraphic units have been developed. The Quaternary formation in the Vennar sub-basin is characterized by a thin lower layer of sandy horizon separated by a clay bed from a top layer of sandy zone between 8 to 12m. The lower thin layer of sandy occurs mainly in the eastern part of Vennar sub-basin. The upper sands zone is semi-confined by the deposit of grey silt of 8 m thickness. The fluvial deposits consisting of clean sands intercalated with brown and black clays occur on Cauvery river course. The thickness of these deposits is about 12m at Ground Anicut at the western end of study area and increases in the easterly direction to about 40m near the coast.



Geology map of Thanjavur District

5. Drainage of Irrigation pattern

The district is a part of delta formed by Cauvery River. It has gentle slope towards east and southeast. The Kollidam River forms the northern boundary and flow from west to east. The Grand Anaicut is located at the western boundary, at this point Cauvery splits into Cauvery and Vennar. A regulator at Tirukkatupalli splits Cauvery into Cauvery and Kodamurti rivers. At Thenperumbur anaicut Vennar splits into Vennar and Vettar. In addition to these, the rivers split into many streams before reaching the sea.

Thanjavur River Map

The chief irrigation sources in the district are canals tanks, tube wells and ordinary wells. Irrigation is highest in the Orathanadu block followed by Ammapet, Thanjavur, Thiruvidaimarudur and Thiruppanandal blocks.

The block-wise and source-wise net area irrigated (2005-06) in Ha is given below.

S. No.	Block	Net area irrigated by					Total Gross Area irrigated
		Canals	Tanks	Tube wells	Ordinary wells	Other Sources	
1	Thanjavur	15676	40	2540	268		18524
2	Budalur	10639	130	1404	12		12185
3	Thiruvaiyaru	10988	-	1928	-		12916
4	Orattanadu	14280	-	11833	-		26113
5	Thiruvonam	7256	174	4151	-		11581
6	Pattukkottai	9072	80	2259	196		11607
7	Madukkur	6628	48	2272	24		8972
8	Peraavurnai	7824	-	5058	1		12883
9	Sethubhavachatram	7184	28	1474	12		8698
10	Kumbakonam	10871	-	1616	-		12487
11	Thruvidaimarudur	13207	-	1122	-		14329
12	Thiruppanandal	12986	-	210	-		13196
13	Papanasam	7857	-	482	-		8339
14	Ammapettai	20910	-	930	-		21840
	Total	**155378**	**500**	**37279**	**513**		**193670**

6. Land Utilisation Pattern in the District: Forest, Agricultural, Horticultural, Mining etc.,

The nine-fold lands use (2005-06) classification for the district is given below

S. No.	Classification	Area (Ha)
1	Forest	3390
2	Barren & Uncultivable Lands	2149
3	Land put to non agricultural uses	81676
4	Cultivable Waste	14700
5	Permanent Pastures & other grazing lands	1385
6	Groves not included in the area sown	5010
7	Current Fallows	9404
8	Other Fallow Lands	29913
9	Net Area sown	192030
	Total	**339657**

7. Surface Water and Ground Water Scenario of the District

7.1 Hydrogeology

The district is underlain by the various geological formations ranging in age from Archaean to Recent, Ground water occurs in six different aquifers in this district. They are Archaean aquifers, Cretaceous aquifers, Eocene Aquifers, Miocene Aquifers, Pliocene Aquifers and Quaternary Aquifers.

Archaean aquifers: Ground water occurs to a limited extent in weathered and fractured rocks under unconfined and semi-confined to confined conditions respectively. The depth of weathered zone ranges from 10 to 12 m. The depth of dug wells is in the range of 8 to 12 m bgl and depth of the bore wells is in the range of 100 m bgl. The yield of dug wells

ranges between <1 and 2 lps, while the yield of bore wells ranges from 1 and 2 lps.

Cretaceous aquifers: The course gravely clay bound sand constitutes these aquifers. The maximum thickness of these aquifers is 50 m. Ground water occurs under confined conditions. Dug cum bore wells of well depth ranging from 8 to 10 m bgl with bores at the bottom to the depth of 25 to 30 m bgl are used for irrigation. The yield of the wells ranges from 5 to 7 lps.

Eocene Aquifers: Sand, silt and clay constitute these aquifers. The thickness of the aquifer is around 80 m and ground water occurs under confined conditions. Tube wells tapping these aquifers are in the range of 120 to 300 m bgl and yield of these wells in between from 5 to 10 lps.

Miocene Aquifers: Sand, stone, gravel with clay and limestone constitute the aquifer. The aquifer can be divided into two hydraulically interconnected i) lower Orathanadu aquifer zone and ii) upper or main flowing zone.

Orathanadu aquifer zone: The thickness of the aquifer ranges between 30 and 70 m and ground water occurs under confined condition. The depth of tube wells tapping these aquifers is in the range of 150 m bgl and the yield of the wells range between 10 and 18 lps.

Main flowing zone: Coarse-grained sand constitutes these aquifers in Cauvery sub basin, while fine-grained sands constitute the aquifer in New Delta area. The thickness of the aquifer is around 35 m and ground water occurs in confined conditions. Depth of the tube wells tapping these aquifers is around 100 m bgl and yield of these wells is of the order of 1 to 5 lps.

Pliocene Aquifers: Sand, gravel, sandy clay and variegated clay constitute the aquifers. The aquifer is present to a limited extent in the district. The thickness of the aquifer ranges

from 10 to 35 m and ground water occurs under unconfined to confined conditions and are developed through shallow tube wells and dug cum bore wells. The depth of the tube wells is in the range of 40 to 100 m bgl. While the dug wells are in the range of 5 to 10 m bgl with 25 to 30 m bgl deep bore at the bottom of the wells. The yield of the wells is in the range of 1.7 to 7.5 lps.

Quaternary Aquifers: The aquifers comprises of sand, clay and silt. The wide variation in the proportion, both laterally and vertically has resulted in the wide variation in aquifer parameters and yields. The thickness of aquifer ranges from 3 to 25 m. Aquifer at shallow depth is tapped by filter points of 8 to 12 m depth, while the shallow tube wells of depth 20 to 40 m tap the aquifer at depth. The yield of the wells ranges from 8 to 12.5 lps.

i. **Pre-monsoon water level:**

The depth of water level during pre-monsoon (May2006) ranges from 1.55 and 18.32 m bgl. During pre monsoon, the Water level in the northern half of the district is in the range of 0.2 to 5 m bgl and in the southern half of the district, the Water level is in the range of >5 to 10 m bgl.

ii. Post-monsoon water level:

The depth of Water level during post-monsoon (Jan2007) ranges from 0.22 to 19.20 m bgl. During post monsoon, the Water level in the entire canal command areas is <2 m bgl..

Long Term Fluctuation (1998-2007)

The long term water level fluctuation for the period 1998-2007 indicates that during pre monsoon there is a rise in the order of 0.0027 to 0.3276 m/year and the fall in the order of 0.0097 to 0.7347 m/year, where as during the post monsoon rise in water level is in the order of 0.0221 to 0.0724m/year and the fall is in the order of 0.0033 to 0.9427 m/year.

Aquifer Parameters

Transmissivity of different aquifers in this district is tabulated below

S. No.	Aquifer	Transmissivity (m^2/day)
1	Cretaceous aquifers	Ranges up to50
2	Eocene Aquifers	1600 to 1800
3	Miocene aquifers:	
	Lower Orathanadu Aquifers	10 to 1400
	Main flowing zone	Ranges up to 1350
4	Pliocene Aquifers	50 to 400

Ground Water Quality

Ground water quality of phreatic aquifers in Thanjavur district is, in general, colorless, odorless, and slightly alkaline nature. The electrical conductivity of ground water in phreatic zone during May 2006 was in the range of 279 to 12250 µS/cm and major parts are having the electrical conductivity below 1500 µS/cm at 25° C.

It is observed that the ground water is suitable for drinking and domestic uses in respect of all constituents except total hardness, sulphate and nitrate. Around 50 percent samples are having higher concentration of NO_3 than the BIS permissible limit. The incidence of high total hardness of attributed to the composition of litho units constituting the aquifer in the district, whereas the nitrate pollution is more likely due to the use of fertilizers for agriculture.

With regards to irrigation suitability based on specific electrical conductance and Sodium Absorption Ratio (SAR), it observed that ground water in the phreatic zone, may cause medium to high salinity and alkali hazard. Proper soil management strategies are to be adopted while using ground water for irrigation.

Groundwater Development

The stage of ground water development in the district is in the range of 18 to 160 %. The ground Water development is minimum in Budalur block and it is maximum in Thiruvidaimaruthur block. Out of 14 blocks, three block over exploited, one block is critical and three blocks are semi-critical stage. However, ground water development in various parts of the district is not uniform or homogeneous. It is therefore imperative that there should be some control on the ground water development and management of ground water.

Shallow aquifers meet the demand of water supply both for drinking and irrigation in the Cauvery sub basin area, while in the area west of Grand Anaicut canal, shallow and medium aquifer cater to the needs. In the Grand Anicut canal command area medium and deep aquifers with the popularly known main flowing zone satisfy the domestic and irrigation needs of the people.

The ground water development in the district is shown below.

Stage of ground water development in Thanjavur district as on 31st March 2004

Block	Net Ground water avail- ability (Ha. m.)	Existing Gross Draft for irrigation (Ha. m)	Existing Gross draft for domestic and industrial water supply (Ha. m)	Existing Gross draft for all uses (Ha. m)	Allocation for domestic and industrial requirement supply up to next 25 years (2029) (Ha. m)	Net ground water availability for future irrigation development (Ha. m)	Stage of ground water development (%)	Category of block
Ammapettai	6353.49	5842.48	190.57	6033.05	196.88	314.13	95	Critical
Budalur	7081.58	1094.35	186.18	1280.53	192.34	5794.89	18	Safe
Kumbakonam	5894.90	5570.05	354.39	5924.44	366.12	-41.27	101	Over exploited
Mudukkur	3787.28	3008.19	161.63	3169.82	166.98	612.11	84	Semi critical
Orattanadu	6126.95	3196.31	337.18	3533.49	348.34	2582.3	58	Safe
Papanasam	4644.33	1439.13	568.53	2007.66	587.35	2617.85	43	Safe
Pattukkottai	7103.86	3569.97	690.91	4260.88	713.78	2820.11	60	Safe
Peraavurnai	2688.02	1646.59	36.18	1682.77	37.37	1004.06	63	Safe
Sethubhavachatram	3179.81	1862.25	350.15	2212.39	361.74	955.83	70	Safe
Thanjavur	10453.48	4086.78	285.92	4372.70	295.38	6071.31	42	Safe
Thiruppanandal	3844.76	4073.19	208.68	4281.87	215.59	-444.02	111	Over exploited
Thiruvaiyaru	4281.07	3350.85	235.44	3586.29	243.23	686.99	84	Semi critical
Thruvidaimarudur	4972.64	7489.67	474.49	7964.16	490.20	-3007.23	160	Over exploited
Thiruvonam	3193043	2378.46	99.57	2478.03	102.87	712.11	78	Semi critical
Total	**73605.60**	**48608.27**	**4179.82**	**52788.09**	**4318.17**	**20679.16**	**76.21**	

Water Conservation and Artificial Recharge

Thorough understandings of the geomorphologic, geological and hydrogeological features are necessary pre requisites for selecting the area suitable for and the type of artificial recharge. The suitability of an area for artificial recharge depends mainly on geological and hydrological boundaries, recharge and discharge characteristics and aquifer parameters. Availability of source water for recharge, long-term trend of ground water levels, availability of unsaturated dried up aquifer zones and ground water quality are other important consideration in this regard.

As far as Thanjavur district is concerned majority of the area is covered by anycut lands. Numerous rivers and canals cuddling across the levee complexes charge the water table aquifer. Areas other than levees are covered by clayey formation. Hence, de-silting of existing ponds and Ooranies are recommended for artificial recharge.

CGWB had prepared a master plan to augment groundwater potential by saturating the shallow aquifer taking into consideration the available unsaturated space during post monsoon and available uncommitted surplus run off. Subsequently, computations have been made for Drought Prone Area Program (DPAP) for over exploited and critical blocks in the districts warranting immediate attention. Institute of Remote Sensing, Anna University had prepared block wise maps demarcating potential zones for artificial recharge for the State of Tamil Nadu. Subsequently, State Government agencies have constructed artificial recharge structures with their own fund or with fund from Central Government, dovetailing various government programs.

Ministry of Water Resources, Government of India has initiated Dug Well Recharge Scheme in the State. The scheme is being implemented by the Nodal Department (SG&SWRDC, PWD, WRO, Government of Tamil Nadu) with the technical guidance of CGWB. The subsidy of Rs. 4000/- for small and marginal farmers and Rs. 2000/- for the other farmers is credited to the beneficiaries' bank account through NABARD. The scheme after implementation will prove to be beneficial to the irrigation sector.

The available uncommitted surplus run off has to be recomputed, taking into consideration the quantum of recharge effected through existing irrigation dug wells also. The existing structures and uncommitted surplus flow should be considered for further planning of artificial recharge program.

On the basis of experimental studies, it has been found that de-silting of existing tanks followed by percolation pond with recharge wells, recharge shafts are economical.

There is considerable scope for implementation of roof – top rainwater harvesting in the district. Recharge pits / Shafts / trenches of suitable design are ideal structures for rainwater harvesting in such areas. Central Ground Water Board is also providing free technical guidance for implementation of rooftop rainwater harvesting schemes.

8.Climate and Rainfall of the District

Within the Thanjavur district the rainfall is uneven. The annual normal varies partially from 1179 mm (Lower Anaicut) to 763 mm (Budalur). The rainfall is high on the eastern part of the district compared to the western part. The district receives major portion of its annual rainfall during northeastern monsoon (Oct-Dec). A moderate amount of rainfall is received during the southeast monsoon period (Jan-Sept).

Since the northeast monsoon rainfall is dominating, its effect is felt on the eastern part of the district (Kumbakonam-698 mm, Aduthurai-611 mm, Lower Anicut-706 mm). The intensity decreases gradually towards west and the western most part of the district (Thiruvaiyaru-387 mm, Budalur-377 mm). The rainfall in the coastal area is heavy because of cyclonic storms and depressions formed in the Bay of Bengal.

The climate of the Thanjavur district is humid and tropical. The mean maximum temperature of the district (Aduthurai) shows variation between 36.5° in June and 27.8° C in May. The mean minimum temperature shows variation from 22.1° C to 27.1°C in December. The relative humidity varies between 70 and 85 percent, highest occurs during the months of Dec-Jan and the lowest during the month of June.

9. Details of the mining leases of Gravel in the District as per the following format

Sl. No	Name of the Mineral	Name of the Lessee	Address & Contact No. of Lessee	Mining Lease Grant order No. & Date	Area of Mining Lease (Ha.)	Period of Mining Lease (Initial)		Period of Mining lease (1st /2nd renewal)		Date of Commencement of Mining Operations	Status (Working / Non-Working /Temp. Working for dispatch etc.,)	Capitive / Non-Capitive	Obtained Environmental clearance (Yes/No), If yes letter No. with date of grant of EC.	Location of the Mining Lease (Latitude& Longitude)	Method of Mining (Opencast/Underground)
						From	To	From	To						
01	Gravel	A.Krishnamoorthy,	S/o.Appasamy, No.4/29, North street, Thangappaudayan patti, Kurungulam west (Post), Thanjavur Taluk, Thanjavur District.	19.12.2016	3.56.0 Ha.	19.12.2016	18.12.2019	-	-	22.12.2016	Working	Non captive	SEIAA. TN/F.No.5701/1(a)/EC.No.3730/2016, Dated: 26.09.2016.	10° 38' 27.06" N to 10° 38' 35.94" N 79° 04' 38.85" E to 79° 04' 44.85" E	Opencast
02	Gravel	.P.Kalanesan	S/o.Panneerselvam, 25, Thambikottai vadakadu, Pattukottai Taluk, Thanjavur District	03.04.2017	2.90.0 Ha,	03.04.2017	04.04.2020	-	-	08.5.2017	Working	Non captive	SEIAA. TN/F.No.5731/1(a)/EC.No.3731/2016, Dated: 26.09.2016	10° 23' 46.89." N To 10° 23' 54.25" N 79° 27' 13.49" E to 79° 27' 20.17" E	Opencast
03	Gravel	.G.Pasupathi,	S/o.Ganapathi, No.76K, 2nd Street, Arulananda Nagar, Thanjavur Taluk, Thanjavur District.	12.09.2017	4.84.5 Ha	12.09.2017	11.09.2020	-	-	15.2.2018	Working	Non captive	DEIAA.TNJ-1/F.No.75/1(a)/EC.No.1/2017, Dated: 16.06.2017	10° 38' 39.04" N to 10° 38' 49.07" N 79° 04' 34.02" E to 79° 04' 44.73" E	Opencast

04	Gravel	.K.Ulaganambi	S/o.Kulanthaivelu, No.C-28, 3rd, street, Kannan Nagar, Thanjavur Taluk, Thanjavur District.	08.02.2019	3.56.0 Ha	08.02.2019	07.02.2022	-	-	18.2.2019	Working	Non captive	DEIAA-Tnj-I/F.No.75/1(a)/EC.No.9/2017, Dated: 06.08.2018.	10° 40' 47.55" N To 10° 40' 54.33" N 79° 02' 07.44" E To 79° 02' 14.95" E	Opencast
05	Gravel	P.Balasubramanian ,	S/o. Palaniyandi, Koothur 0village , Budalur Taluk Thanjavur District	28.02.2019	1.36.0 Ha	28.02.2019	27.02.2022	-	-	20.3.2019	Working	Non captive	DEIAA-Tnj-I/F.No.75/1(a)/EC.No:10/2017, Dated: 06.08.2018	10° 42' 10.95" N To 10° 42' 15.52" N 78° 53' 58.45" E To 78° 54' 4.10" E E 78°54'0.67"	Opencast
06	Gravel	.S.Anthony Irudhayaraj,	S/o.Simion Raj, No.4/44, Madhakovil Street, Mappillai Naickenpatty, Ravusapatti post, Thanjavur Taluk Thanjavur District	28.02.2019	3.76.0 Ha	28.02.2019	27.02.2022	-	-	13.3.2019	Working	Non captive	DEIAA.TNJ-1/F.No.75/1(a)/EC.No.8/2017, Dated: 13.08.2018	10° 40' 53" N to 10° 41' 03" N 79° 02' 54" E to 79° 03' 03" E	Opencast

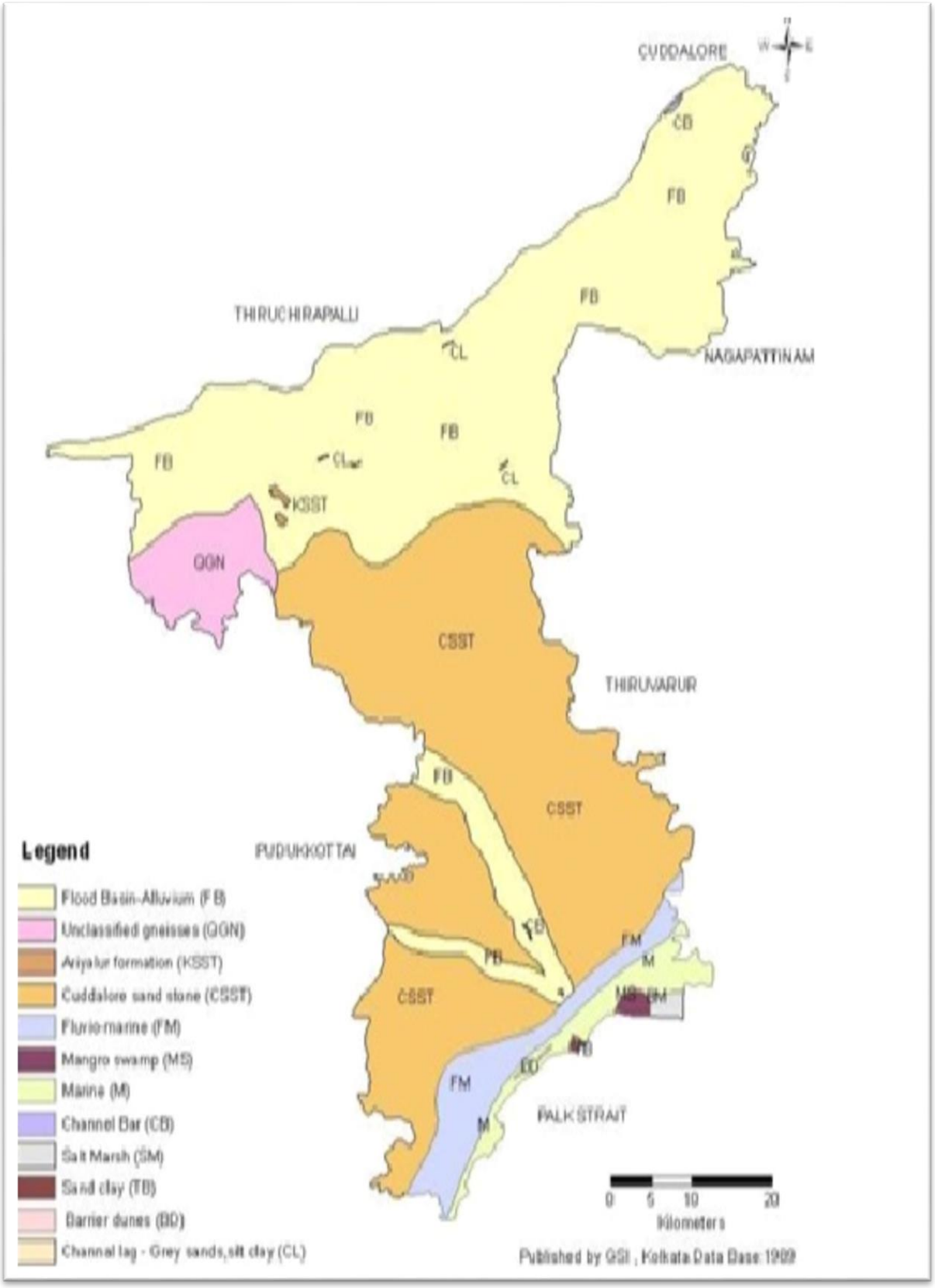
10. Details of Revenue Collected for Gravel during the last Three years

Year	Revenue collection (in Lakhs Rs.)	DMF (in Lakhs Rs.)	NMET (in Lakhs Rs.)
2016-17	05.47500	0.0	-
2017-18	64.97500	2.94750	-
2018-19	11.32000	1.17840	-

11. Details of production of Gravel during the last three years:

Year	Gravel Production (CBM)
2016-17	21025
2017-18	89575
2018-19	32940

12. Mineral map of the District:



BRIEF NOTE ON GRAVEL

BRIEF NOTE ON GRAVEL:

The Gravel quarrying operation in the area of Thanjavur District, where the new industries are springing up in the district. Gravel is an important commercial product, used as filling material. The applicant intends to use for filling and leveling of low lying areas for public Projects. This project will give employment opportunities to youths of that locality. Mineral Industries of the state of Tamilnadu provides employment opportunities for the people of the state as well as in the specific project area.

Mining and Quarrying is one among the major core sector industries which plays a vital process of country's economic development. There is a huge demand of Gravel in Thanjavur District for this a huge quantity of Gravel is required for filling and leveling of low lying areas of road construction projects and other infrastructure development work. Besides there is also huge demand of Gravel for public and private sector projects also. The Gravel is specifically used for filling and leveling of low lying areas for Road Project and other infrastructure development work in and around the District

In respect of Thanjavur district good quality of gravel occur in and around Thanjavur, Vallam, Sengipatti, Budalur areas and Thambikottai areas of Pattukottai Taluk. Now a days Six gravel quarries operating in Thanjavur district.

In Thanjavur taluk, Two quarries are operating in the Kurunkulam west village with total extent of 8.40.5 hects and Two quarries are operating in the Sennampatti village with total extent of 7.32.0 hects.

In Budalur taluk, one quarry is operating in the Palayapatti north village with total extent of 1.36.0 hects. In Pattukottai taluk, one quarry is operating in the Thambikottai maravakadu village with total extent of 2.90.0 hects.

Gravel

Gravel occurs widely in Vallam and adjoining areas of Thanjavur. During the traverses, gravel is found in the following places. Gravel is quarried up to the depth of 3 m near Ayyanar temple, vallam (10° 43' 11.8" N & 79° 04' 16.7" E). In quarry section, gravel is underlain by ferruginous sandstone. Quarry is abandoned.

Fig: Gravel quarried near Vallam

In Kuruvadipatti village, quarries spread over an area about 50 Acres, Gravel is quarried up to the depth of 3m- 5m (10°45'07" N & 79°01'51.9" E). In quarry section, gravel is underlain by ferruginous sandstone. Quarry is abandoned.

Fig: Gravel quarried and abandoned in near Kuruvadipatti village

Gravel mixed with Red soil is quarried in Marudhakudi village (10° 45' 09.5" N & 79° 00' 39.5" E). Quarrying is permitted up to 3 m depth in an area of 3.73 Ha.

Fig: Gravel mixed with Red soil quarried in Marudhakudi village

Red soil mixed with fine gravel is quarried in Thangapudayanpatti village (10° 38' 26" N & 79° 44' 6.8" E). Quarrying is permitted up to 3 m depth in an area of 3.56 Ha.

Fig: Red soil mixed with fine gravel quarried near Thangapudayanpatti village

Red soil underlined by gravel is quarried near Chennampatti village (10°41'16.7"N & 79°02'54.6" E). Quarrying is permitted up to 3m depth. Where Red soil is underlined by gravel.

Fig: Red soil underlined by gravel is quarried near Chennampatti village

13. List of Leases for Gravel in the District:

Sl. No.	Name of the Mineral	Name of the lessee	Address & contact no. of Lessee	Lease Grant order No. & date	Area of mining lease to be allotted (Ha)	Validity of Lease	Use (Captive / Non-capitive)	Location of the Mining lease (Latitude & Longitude)
01.	Gravel	A.Krishnamoorthy	S/o.Appasamy, No.4/29, North street, Thangappaudayan patti, Kurungulam west (Post), Thanjavur Taluk Thanjavur District.	R.C.No.405/G &M/2015 Dated.30.11.2016	3.56.0 Ha.	19.12.2016 TO 18.12.2019	Non-capitive	10^0 38' 27.06" N To 10^0 38' 35.94" N 79^0 04' 38.85" E To 79^0 04' 44.85" E
02	Gravel	P.Kalanesan	S/o.Panneerselvam, 25,Thambikottai vadakadu, Pattukottai Taluk, Thanjavur District	Rc.No.10/G&M/2017 Dated :11.03.2017	2.90.0 Ha,	03.04.2017 TO 04.04.2020	Non-capitive	10^0 23' 46.89" N To 10^0 23' 54.25" N 79^0 27' 13.49" E To 79^0 27' 20.17"E
03	Gravel	G.Pasupathi,	S/o.Ganapathi, No.76K, 2nd Street, Arulananda Nagar, Thanjavur Taluk, Thanjavur District.	Rc.No.350/2016 /Mines dated: 31.08.2017	4.84.5 Ha	12.09.2017 TO 11.09.2020	Non-capitive	10^0 38' 39.04" N To 10^0 38' 49.07" N 79^0 04' 34.02" E To 79^0 04' 44.73" E

04	Gravel	K.Ulaganambi	S/o.Kulanthaivelu, No.C-28, 3rd street, Kannan Nagar, Thanjavur Taluk, Thanjavur District.	Rc.No.383/G&M/2016 dated: ; 31.01.2019	3.56.0 Ha	08.02.2019 TO 07.02.2022	Non-capitive	10° 40' 47.55" N To 10° 40'54.33"N 79° 02' 07.44" E TO 79° 02'14.95"E
05	Gravel	P.Balasubramanian	S/o. Palaniyandi, Koothur village, Budalur Taluk, Thanjavur District	Rc.No. 498/G&M/2015 dated: 06.02.2019	1.36.0 Ha	28.02.2019 TO 27.02.2022	Non-capitive	10⁰ 42'10.95'N to 10⁰ 42'15.52'N 78⁰ 53'.58.45"E to 78⁰ 54'4.10"E E 78⁰54'0.67"
06	Gravel	Thiru.S.Anthony Irudhayaraj,	S/o.Simion Raj, residing at No.4/44 Madhakovil Street, Mappillai Naickenpatty, Ravusapatti post, Thanjavur Taluk and District	Rc.305/2016/Mines dated: 06.02.2019	3.76.0 Ha	28.02.2019 TO 27.02.2022	Non-capitive	10⁰ 40'53" N to 10⁰ 41'03" N 79⁰ 02'54" E to 79⁰ 03'03" E

14. Total Reserve available in the district :

Sl.No.	Name of the Lessee/LOI Holder	Village	Taluk	Gravel Geological Reserves (M^3)
1	Thiru. A.Krishnamoorthy, S/o.Appasamy, No.4/29, North street, Thangappaudayan patti, Kurungulam west (Post), Thanjavur District	Kurungulam (West)	Thanjavur	96300
2	Thiru.P.Kalanesan S/o.Panneerselvam, 25, Thambikottai vadakadu, Pattukottai Taluk, Thanjavur District	Thambikottai Maravakadu	Thanjavur	87000
3	Thiru.G.Pasupathi, S/o.Ganapathi No.76K,2nd Street, Arulananda Nagar, Thanjavur Taluk and District	Kurungulam (West)	Thanjavur	145350
4	Thiru.K.Ulaganambi S/o.Kulanthaivelu, No.C-28, 3rd, street, Kannan Nagar, Thanjavur District	Sennampatti	Thanjavur	70300

5	Thiru.P.Balasubramanian, S/o. Palaniyandi, koothur village , Budalur Taluk , Thanjavur District	Palayapatti (North)	Budalur	40845
6	Thiru.S.Anthony Irudhayaraj, S/o.Simion Raj, No.4/44 Madhakovil Street, Mappillai Naickenpatty, Ravusapatti post, Thanjavur Taluk and District	Sennampatti	Thanjavur	75200

15. Quality /Grade of Mineral availability in the district

Gravel is a loose aggregation of rock fragments. Gravel is classified by particles size range and includes size clases from Granule to boulder sized fragments. Gravel is categorized in to granular gravel (2 to 4 mm) or (0.079 to 0.157 inch) and pebble gravel (4 to 64 mm) or (0.2 to 2.5 inch). ISO 14688 grades gravels as fine, medium and coarse with ranges 2 mm to 6.3 mm, 6.3 mm to 20 mm, 20 mm to 63 mm respectively.

16. Use of Mineral

The Gravel available in the district is mainly used for filling and levelling of the low lying areas and Various National Highway projects and Railway projects in the strengthening of embankment and doubling the roads and Railway tracks.

17. Demand and supply of Gravel in the last three years

S.No	Year	Gravel Production (CBM)	Revenue collection (in Lakhs Rs.)
1	2016-17	21025	05.47500
2	2017-18	89575	64.97500
3	2018-19	32940	11.32000

18. Mining leases marked in the map of the district

At present, there are Six leases for quarrying Gravel. However, the applied areas for grant of quarrying leases for quarrying Gravel are marked in the district map.

Fig: Location of Gravel Quarries in Thanjavur District

19. Details of the area of where there is a cluster of mining leases Viz. Number of mining leases, location (Latitude and Longitude)

Sl. No.	Name of the Mineral	Letter of Intent Grant order No. & date	Area of mining lease to be allotted (Ha)	Village	Taluk	District	Gravel Geological Reserves (Mill.Tons)	Use (Capitive /Non-capitive)	Location of the Mining lease (Latitude & Longitude)
Not Applicable									

20. Details of Eco-Sensitive area, if any in the district

National Parks and Wildlife Sanctuaries are notified as a part of the forest management as dedicated areas for harbouring the representative biodiversity of a place and for providing reproductive surplus to the forests providing harvest based sustainable utilization. Therefore such protected areas are extremely important for conservation of biodiversity, and for ensuring the survival of its floral and faunal components, not only for the present but also for future. However, the rising human population and their growing demands for socio economic development have placed tremendous stress on forests including such areas both directly and indirectly. Keeping in view the fact that a balance has to be struck between development and conservation, any activity involving use or diversion of any part of a notified protected area may be considered only under most exceptional circumstances, taking mainly into account inevitability, its impending impact on the management of the Protected Area, and feasibility of mitigation thereof without compromising the objective thereof. Additionally, such activities to be taken up in the identified wildlife habitats also need to be governed by the orders of Hon'ble Supreme Court as well as the statutory requirements as provided in the Wild Life (Protection) Act, 1972.

There is no Bird sanctuaries, wild life Sanctuaries and National park in Thanjavur district.

21. Impact on the Environment (Air, Water, Noise, Soil Flora & Fauna, Land use, Agriculture, Forest etc.,) due to Mining Activity

Mining and allied operations may affect the existing environmental setup in the area unless proper mitigation measures are not taken. Hence it is essential to assess the impacts of mining on various environmental parameters so that abatement measures could be planned in advance for systematic, sustainable and eco-friendly mining in the area.

21.1 Air Environment

The mining and allied operations may cause deterioration of air quality due to pollution if prompt care is not taken. The principal sources of air pollution in general due to mining and allied activities will be the dust generation in the mine due to:

- Excavation of Gravel,Earth and overburden.
- Movement of HEMM such as excavators, tippers etc.,
- Loading and unloading operation
- Overburden & Gravel transportation

Beside the above mentioned fugitive dust emissions, atmospheric fugitive dust emissions, atmospheric pollution can occur as a result of emission of SO_2, Nox, CO etc., from diesel driven mining equipment, compressors, generators etc., Larger suspended particles are generally filtered in the nose and throat and do not cause problems.

Particulate matter smaller than 10 microns, referred to as PM10, cn settle in the bronchi and lungs and cause health problems like Bronchitis, Emphysema, Bronchi Asthma, Irritation of mucus membranes of eyes etc. Particles smaller than 2.5micrometers(PM 2.5), tend to penetrate into the lungs and very small particles (<100 nanometers) may pass through the lungs to affect other programs.

21.2 Water Environment

The major sources of water pollution normally associated due to mining and allied operations are:

- Generation of Industrial effluent water from workshop, service building.
- Disturbance to drainage course or water bodies in the project area, if any.
- Washouts from waste dumps/embankment, if any.

- Domestic effluent
- Mine discharge water pumped out from opencast mines, if any and effect on ground water table.

Direct impact on human beings due to poor water quality consequent to mining operation can lead to various water borne diseases like diarrhoea, jaundice, dysentery, typhoid etc. Besides, the polluted water may not be useful for animal or human consumption, vegetation and may affect aquatic life, if effluents are not properly treated to remove the harmful pollutants.

21.3 Noise & Vibration

The impact prediction and control measure for noise environment due to mining and allied activities are described below:

Noise is one of the inevitable causes of pollution in mining operations largely due to the extensive mechanization adopted. Since the Gravel in the District is in friable form no drilling and blasting is required for the excavation. Hence the major source of noise will be from the equipment's such as Excavation, loading & unloading & movement of vehicles etc., will produce noise of considerable magnitude in mining operations. Prolonged exposure to a high noise level is harmful to the human auditory system and can create mental fatigue, rebellious attitude, annoyance and carelessness, which may lead to neglect of work and also results in accidents.

The Gravel in this region is in friable form and can be excavated directly by using hydraulic excavator and there will not be any drilling and blasting involved in the mining operation. Hence, vibration due to blasting is not envisaged.

21.4 Impact on Land Environment:

Due to mining and its allied activities there will be some changes to the pre-mining land status due to the following activities:

- Excavation of Ore and waste/ Overburden
- Temporary side casting / Backfilling of waste / overburden.
- Construction of Infrastructure facilities such as office, road, site services etc.,

21.5 Impact on Biological Environment

The major possible impact on biological environment due to mining is given below:

- Clearance of vegetation due to mining and allied activities
- Retardation of tree growth, tip burning etc., due to deposition of dust and the particulate matter generated from the mining operation.
- Presence of Schedule-I fauna in the mining area.
- Proposed impact on surface water quality that also provides water to wildlife
- Risk of fall/slip or cause death to wild animals due to project activities
- The project releases effluents into water bodies that also supplies water to wildlife
- Diversion of Agricultural and forest lands for mining
-

22. Remedial Measure to mitigate the impact of Mining on the Environment

The following remedial measures to be taken during mining

22.1 Remedial Measures to mitigate Air Pollution

- Water sprinkling on mineral transport road from the mines to the main road
- Black topping of the main transportation roads to the possible extent.
- Avoiding crowding of trucks by properly spacing them to avoid the concentration of dust emission at any time
- Covering the trucks by tarpaulin sheets during ore transportation
- Proper maintenance of HEMM to minimize gaseous emission
- Imparting sufficient training to operators on safety and environmental parameters
- Development of green belt / plantation around mine, along the roads, backfilled area in various undisturbed areas within the mine lease areas etc.,

22.2 Remedial Measures to mitigate water Pollution

- Industrial effluent treatment systems wherever necessary to be introduced and maintained properly.
- Safety barriers to be provided for all water bodies and no mining activities should be carried out in the safety barrier area.

- Mitigative measures like construction of garland drains formation of earth bunds to be followed in the waste dumping areas to avoid wash off.
- Domestic effluents to be treated in scientific manner
- Required statutory clearances to be obtained and all precautionary measures to be adopted wherever pumping of ground water is involved.

22.3 Remedial Measures to reduce Noise & Vibration

- Planting rows of native trees around mine, along the roads, other noise generating centres to act as acoustic barriers.
- Sound proof operator's cabin for equipment may lead to less noise generation.
- Proper and regular maintenance of equipment may lead to less noise generation
- Air silencers of suitable type that can modulate the noise of the engines of machinery to be utilized and will be maintained effectively.
- Providing in-built mechanism for reducing sound emissions.
- Providing ear muff's to workers exposed to higher noise level and to those persons operating or working close to any machine.
- Conducting regular health check-up of workers including Audiometric test for the workers engaged in noise prone area.

22.4 Remedial measures to reduce Impact on Land Environment:

Scientific reclamation measures to be adopted to reduce the impact of land environment due to mining. Gravel being shallow deposit backfilling of mined out voids may be practiced to avoid land degradation.

22.5 Remedial measures to reduce Impact on Biological environment

- The Gravel bearing areas in the district is mostly of dry areas, afforestation to be carried out in the mining areas.
- Necessary mitigative measures like dust suppression, proper maintenance of equipments, black topping of roads etc., to be carried out to prevent dust generation & any further impact on the vegetation.
- Conservation plan for schedule –I species if any to be prepared in consultation with the Forest Department and the proposals given in the conservation plan to be strictly implemented.

- Effluents generated in the mining areas to be treated properly.

23. Reclamation of Mined out Area (Best practice already implemented in the district, requirement as per rules and regulations, proposed reclamation plan)

Gravel deposit in the district is of shallow depth. The reclamation of mined out lands by simultaneous backfilling and development of plantation in the backfilled areas will be the best practice of reclamation.

24. Risk Assessment & Disaster Management Plan

Risk Assessment and Disaster Management plan in connection with mining and allied operations should be spelt out in detail to cover possible dangers /risks/explosions/accidents etc., likely to arise from the project operations including onsite and off-site emergency plans to meet the disastrous situations if any.

The management is able to deal with the situation efficiently to reduce confusion keeping in view of the likely sources of danger in the mine.

1) Outline of Disaster management plan :-

The purpose of disaster management plan is to restore the normalcy for early resumption of mining operation due to an unexpected, sudden occurrence resulting to abnormality in the course of mining activity leading to a serious danger to workers or any machinery or the environment.

2) System of communication:-

An internal communication system should be provided. Telephone nos. and addresses of adjoining mines, rescue station, police station, Fire service station, local hospital, electricity supply agency and standing consultative committee members should be properly updated and displayed.

3) Consultative committee:-

A standing consultative committee will be formed under the head of Mines. The members consists of Mines manager /safety officer / medical officer / public relation officer/Foreman/ and environmental engineer.

4) Facilities & Accommodation:-

Accommodation and facilities for medical centre, rescue room and for various working groups shall be provided. Regular checking of these facilities shall be undertaken.

5) First Aid & medical facilities:-

The mine management should be having first aid / medical centre for use in emergency situation. All casualties should be registered and should be given first aid. The centre should have facilities for first aid & minor treatment, resuscitation, ambulance and transport. Proper telephone / wireless should be provided for quick communication with hospitals where the complicated cases are to be referred. Regular checking of these facilities shall be undertaken by the doctor and the in charge of the first aid room.

6) Stores and equipment :-

A detailed list of equipment available, its type & capacity and items reserved for emergency should be maintained.

7) Transport services:-

A well defined transport control system should be provided to deal with the situation.

8) Functions of public relations group:-

Liaison with representatives of the mine workers is required to ameliorate the situation of panic, tension, sentiments, grievances and misgivings created by any disaster. Management is required to ameliorate the injured, survivors and family members of affected persons by providing material, finance, moral support and establishing contact with relatives of victims. The consultative committee formed, especially the nominated public relation officer shall look into these aspects.

9) Security :-

Manning of security posts is very essential during the disaster management.

10) Catering & Refreshment :-

Arrangement will be made for the victims, rescue teams and others.

25. Details of Occupational health issue in the District (last five –year data of number of patients of silicosis & Tuberculosis is also needs to be submitted)

The details of number of patients treated for silicosis and Tuberculosis for the last five years in the district is given below:

Sl.No.	Year	Number of patients treated for silicosis	Number of patients treated for Tuberculosis
1	2018	Nil	2419
2	2017	Nil	2995
3	2016	Nil	2776
4	2015	Nil	2642
5	2014	Nil	2651

26. Plantation and Green belt development in respect of leases already granted in the district

It is necessary to develop Green belt in and around the polluted site with suitable species to reduce the air pollution effectively. Implementation of afforestation program is of paramount importance. In addition to augmenting existing vegetation, it also checks soil erosion, make the ecosystem more complex and functionally more stable and make the climate more conductive.

Gravel deposits being shallow in depth, mining simultaneous backfilling method will be followed in most of the mining areas. During the operations, the plantation will be proposed and will be carried out on the safety barrier areas and also on the mined out and backfilling areas.

27. Any other Information

The details related to the occurrence of mineral resources and other data of the district are subject to updating from time to time. Before grant of any quarry lease, the parameters related to geosciences and sustainable development are to be considered on the basis of ground reality.

Assistant Director
Geology and Mining,
Thanjavur

District Collector
Thanajvur