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Liquid Waste Dumping Site Suitability Analysis for Chengalpattu Taluk Using GIS

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Abstract: The management of the waste is the main problem faced by all community. Proper management of the waste helps in safe and clean environment. The study area includes one of the developing community which lacks waste management. The objective of the study involves in selecting suitable site for construction of waste water treatment plant for proper waste disposal. The process involves in preparing various thematic maps and providing it with rank and weightage. These various thematic maps are analyzed by interpretation and by overlaying using GIS software. The overlaid map is classified into four category representing unsuitable, less suitable, moderately suitable and most suitable from which the best site for treatment plant is selected.

Keywords: Interpretation, Overlaying, Thematic maps, Waste management, Weightage.

I. INTRODUCTION

The waste disposal is one of the main problems faced by every developing community. The development of proper waste management is the tedious process. The proper site for disposal of the liquid waste for the Chengalpattu town is done effectively using GIS software. The study area is analysed for various parameters and are integrated to get the suitable site for construction of treatment plant.

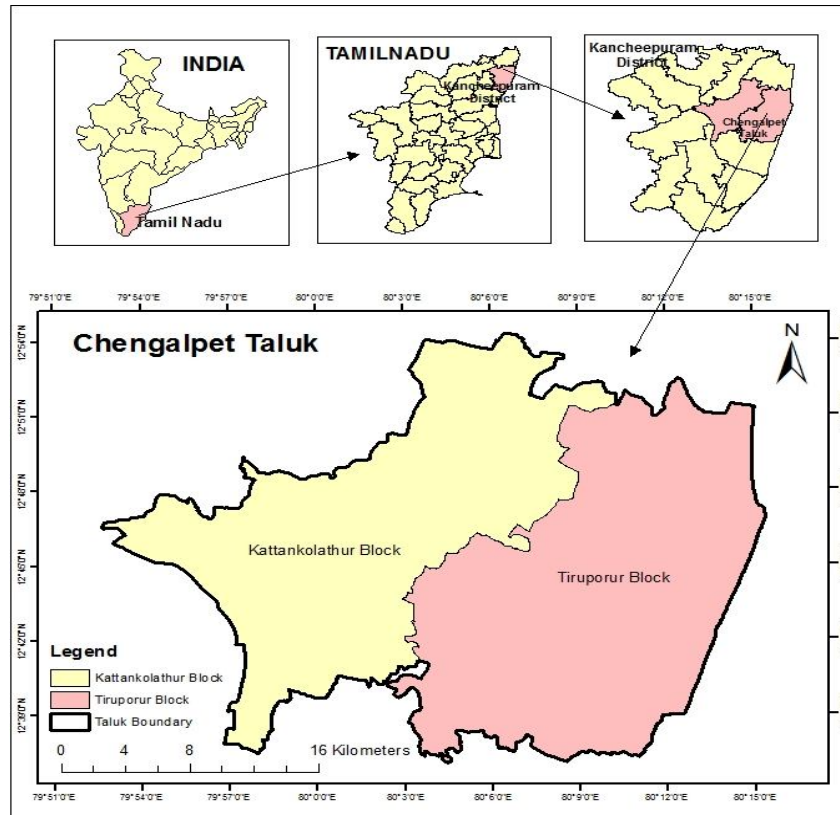
II. STUDY AREA

Chengalpattu is a taluk in Kanchipuram district which is situated in the north east of Tamil Nadu state in India. It lies between 12°38' to 12°51' N and 79°51' to 80°15'E (Fig. 1). The average elevation of study area is 36 meters and total population is 571257 in 2011 census. A river called Palar is passing through the northern side of Chengalpattu and it also has a lake in its north eastern side which is called Kolavai Lake. The temperature lies between 30° to 39° c. Chengalpattu generally experiences hot and humid climatic conditions throughout the year. Temperature reaches at maximum between April to July and the day time heat is oppressive during summer season the temperature comes down during December to February. An average humidity of 55% to 85 % is prevailed throughout the year. The soil type in this area is highly inferior and highly stony or mixed with lime, gravel, soda and laterite.

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III. METHODOLOGY

The base map has been prepared from the toposheet in 1:50,000 scale and is converted in digital format using GIS. The datas are acquired from the landsat images. The various thematic maps are prepared by digitizing. The thematic maps are given rank and weightage and are interpreted. The rank and weightage calculation are done by pairwise comparison method. About six thematic maps are interpreted and overlaid to get the suitability map.

IV. PAIRWISE COMPARISON METHOD

TABLE. 1 PAIRWISE COMPARISON

	Less important			More important		
	Land use/ Land cover	Soil	Tank	Geology	Geomorphology	Slope
Land use/ Land cover	1					
Soil	1/2	1				
Tank	1/3	1/2	1			
Geology	1/4	1/3	1/2	1		
Geomorphology	1/5	1/4	1/3	1/2	1	
Slope	1/6	1/5	1/4	1/3	1/2	1

TABLE. 2 WEIGHTS DERIVED BY CALCULATING THE PRINCIPAL EIGEN VECTOR OF PAIRWISE COMPARISON MATRIX

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Factor	Eigen Vector Weight	Percentage (%)
Land use/ Land cover	0.3824987893	38.24987893
Soil	0.2503570573	25.03570573
Tank	0.1595629487	15.95629487
Geology	0.1006449596	10.06449596
Geomorphology	0.0641027345	6.41027345
Slope	0.0428335106	4.28335106
Total		100

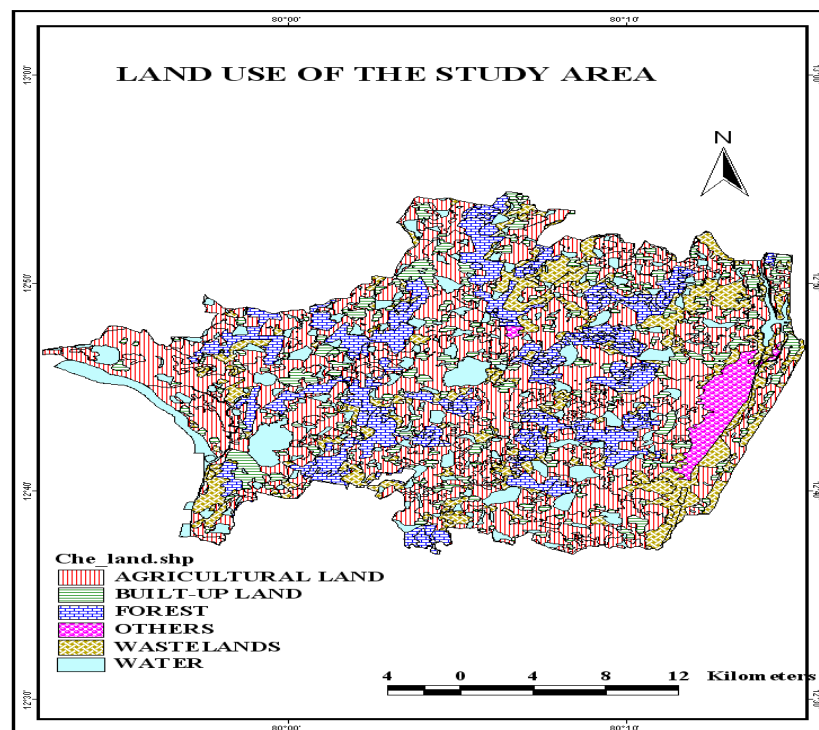
V. THEMATIC MAPS

Thematic maps are maps which have particular theme. Six thematic maps have been considered for the integration and they are listed below in the priority order.

1. Land use/Land cover
2. Soil
3. Tank
4. Geology
5. Geomorphology
6. Slope

LAND USE / LAND COVER

The land surface is categorized based on its usage. The land cover of the study area comes under the category Agricultural land, Waste land, Build-up land, Forest, Water body, Others like grass land, barren land, etc (Fig. 2).



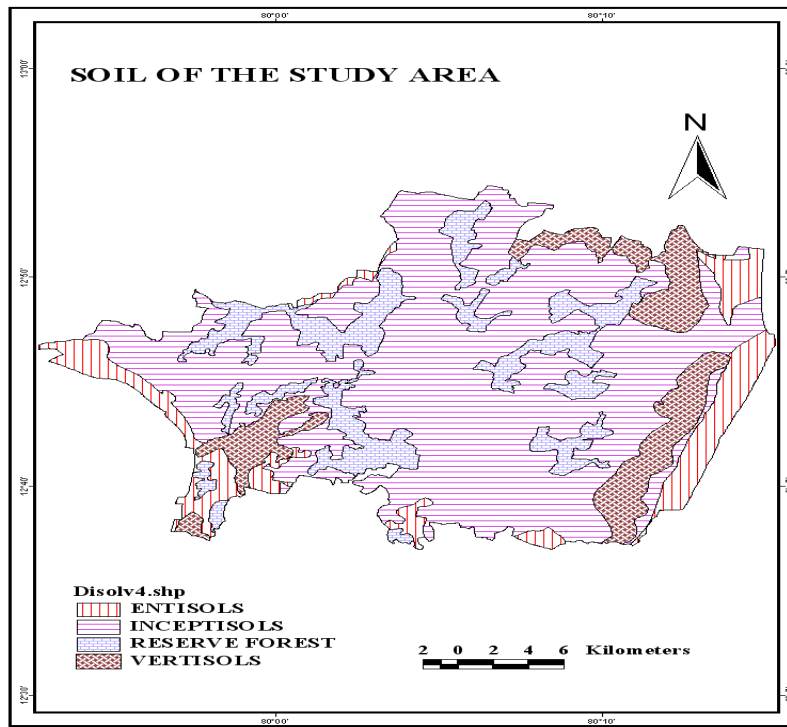
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SOIL

The topmost layer of the earth which is formed by weathering of rocks is known as soil. The study area includes four different category. Entisols are partially clayey soil formed from sedimentary rocks. Inceptisols has no accumulation of clay, iron oxide, aluminium oxide. Reserveforest is the area covered by thick trees, plants, etc. Vertisols are expansive clayey soil which expands more during rainy season (Fig. 3).



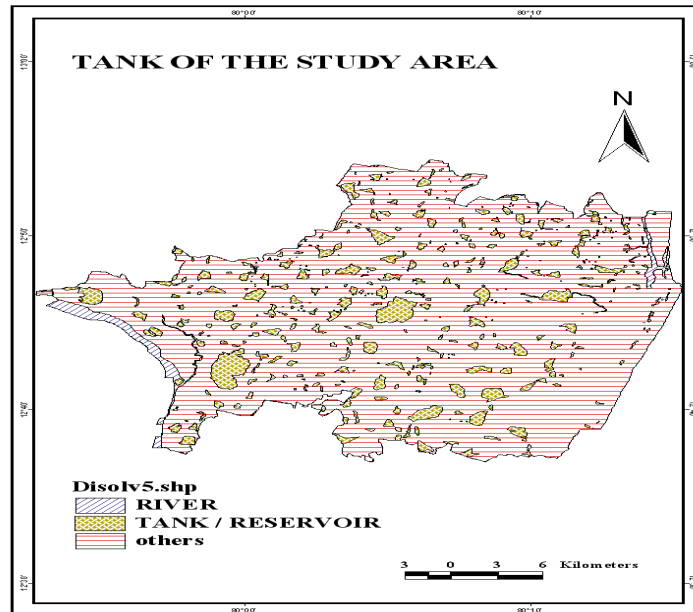
TANK

The water bodies and the tanks are considered from the study area for preparing this map. The reservoirs are also taken into consideration. The dumping of waste affects the water quality of the area. So it is necessary that the dumping site should be far way from water body. The tank map is given below (Fig. 4).

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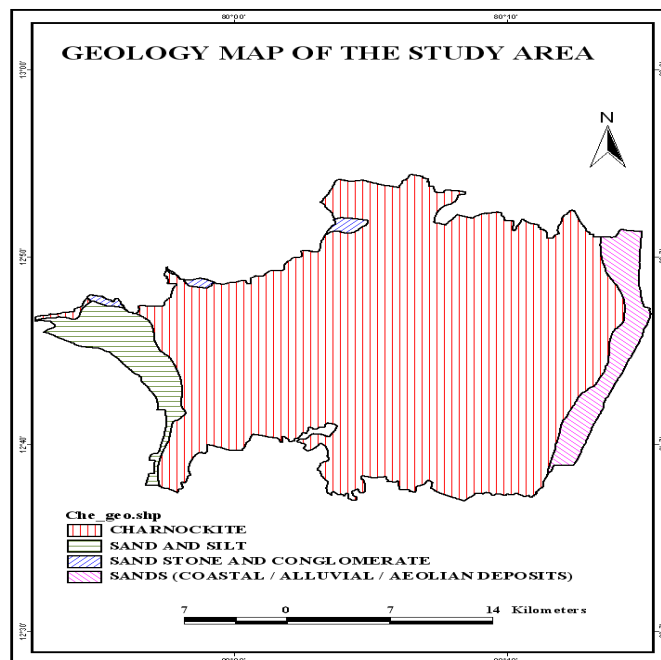
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GEOLOGY

The study area comprises of the following litho units like soil, alluvium (sand and silt); sand stone; charnockites; sand stone and conglomerate are found in the study area. Based on this category the thematic map is prepared (Fig. 5).



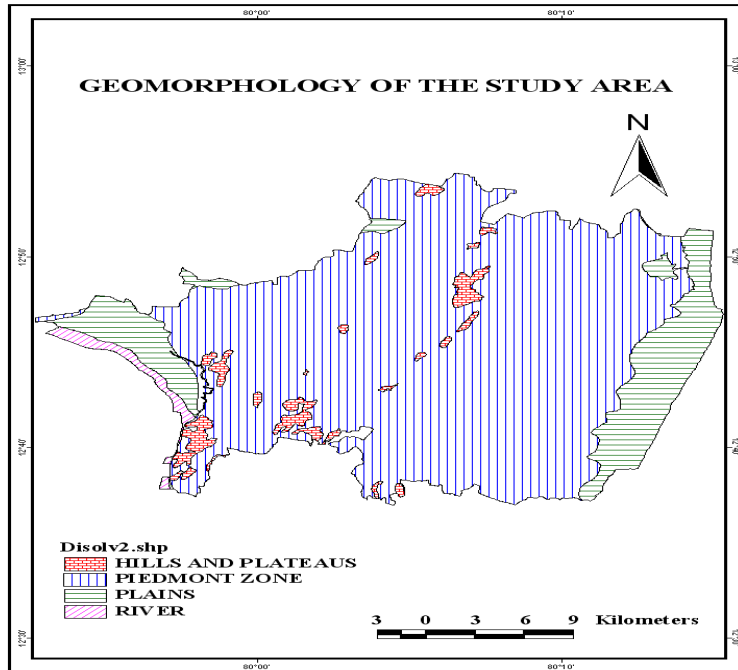
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GEOMORPHOLOGY

The surface features of the earth are referred as Geomorphology. The study area contains plains, hills and plateaus, piedmont zone, etc. Piedmont zone refers to the loose soil surrounding foot of the mountains (Fig. 6).



VI. OVERLAY ANALYSIS

Each thematic maps are categorized into four category and are interpreted and overlaid based on their effect in selection of suitable site for dumping. The categories area listed in the Table 3. These maps are overlaid using GIS software by giving the suitable rank and weightage and the final map is categorized into four category which represents unsuitable, less suitable, moderately suitable and most suitable.

TABLE. 3 CATEGORIES FOR OVERLAY ANALYSIS

PARAMETER	LEVEL OF SUITABILITY/VALUE			
	Unsuitable 1	Less suitable 2	Moderate suitable 3	Most suitable 4
LAND USE	Agriculture/ build up area	Water	Forest	Waste land/others
SOIL	Reserve forest	Inceptisols	Vertisols	Entisols
TANKS	River	Tank/reservoir	-	Others
GEOLOGY	Coastal/ Alluvial/ Aeolian deposits	Sand stone and conglomerate	Sand and silt	Charnockite
GEOMORPHOLOGY	River	Hill & plateau	Piedmont zone	Plains
SLOPE	Others	-	-	Plain

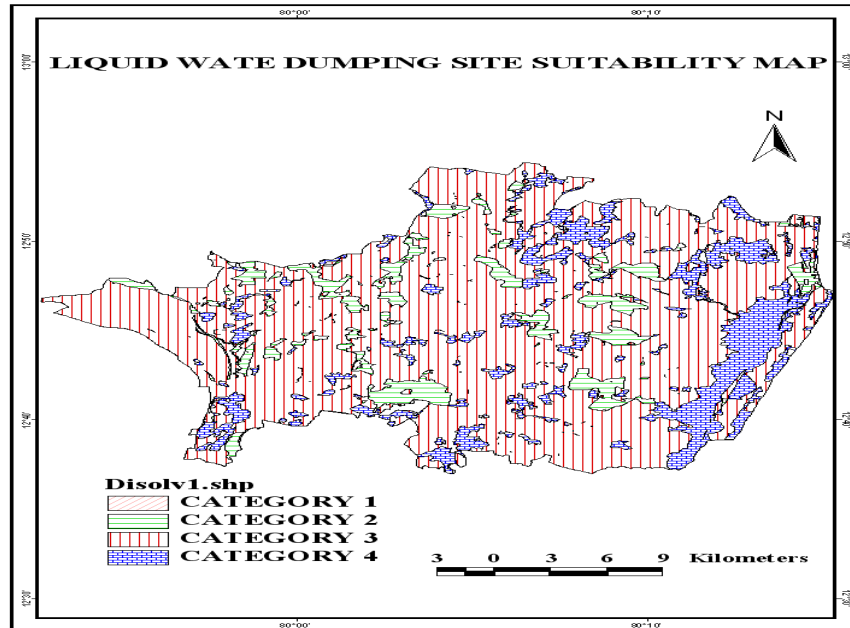
The final integrated map shows the best suitable site for construction of the treatment plant. The suitable area in the map is represented as category 4. The integrated GIS study indicates that the study area comprises three category 2, category

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3 and category 4. The category four is the most suitable area for dumping the liquid waste. The most suitable area is best suited for construction of the liquid waste dumping.



VII. CONCLUSION

Thus the study area is analysed and the liquid waste dumping site is selected by using GIS software. The study shows south west part and western part have the best site for the construction of treatment plant. The area near south western part of the study area falls near the town. This is the ideal site for the waste disposal. Hence the GIS has been effectively used for the site suitability analysis for the study area.

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