International Journal of Scientific Research & Engineering Trends
Volume 9, Issue 2, Mar-Apr-2023, ISSN (Online): 2395-566X

Interlinking of Local Water Bodies in the Villages of Thethakkudi, Mayiladuthurai District, Tamilnadu, India

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Abstract- Interlinking of water bodies involves the process of diverting surplus water through a network of canals. Through which the water bodies can holds water for a much longer period than in the past. This would cover additional areas for irrigation, remove the imbalance in availability of water and create the way for effective utilization of available water resources. Therefore, this project will offer interlinking of local water bodies through the link water channels at micro-level in the village of Thethakkudi. The Thethakkudi is a village in Mayiladuthurai district in Indian state of Tamil Nadu. The present population of the village is 358. Out of these 129 are men, 141 are women and 88 are children. The village is administered by the Kathiruppu Panchayat, which covers an area of 0.98km2. Thethakkudi has an average elevation of 4m and is located 11km from the coast of Bay of Bengal. Even this income they get from outstations because of the lack of quantity and quality of water resources. Therefore, the agriculture in this village is also being destroyed. Currently there are more than 20 excavated ponds and puddles are available. Very few ponds are seasonal at best, and their water does not last beyond monsoons. Most of the ponds are get water from rainfall, also dry up as early as March. So, the process of diverting surplus pond water through a network of canals to relatively drier areas are more useful for agriculture development of the village. Therefore, the aim of this project is to improve the agricultural practices through interlinking of ponds depending upon the local topographical survey using Remote Sensing and GIS. The Remote Sensing and GIS with DEM Techniques are used to study topography of the ground and to analyze the morphologic characteristics easily, quickly and at low cost. The benefits accruing from this project are crop diversification, better farm practices, improving food productivity, rejuvenation of groundwater and improving revenue of farmers.

Index Terms- Water bodies, Interlinking, Remote Sensing & GIS, DEM, Topography.

I. INTRODUCTION

Water is one of the most important natural resources on earth and it can be found in various forms on earth. There are various water bodies which divide into categories of salt and fresh as well as small and large. Their features differentiate them from each other. You have must have seen oceans, streams, ponds and more. All of these are bodies of water only which carry the utmost importance for life on earth. Global natural changes and the need for various utilization of expanding populace make water the board of troublesome assignment, particularly in creating nations like India with detonating populace and powerless economy. All the more explicitly, developing interests across serious areas, expanding dry seasons, declining water quality, especially of groundwater, unabated flooding, between-2.5% in the form of glacier and ice caps and only of the order of 0.01% is available in lakes and streams, the remaining 0.04% being in other forms. However, it has fulfilled most of the requirements of the human being for various utilities. In recent decades, availability and utilizablity of surface water is diminished due to contamination by natural and anthropogenic activities. In this scenario, the precious and invisible natural resource of groundwater has become a supplementary resource for the human needs. Groundwater is used for domestic and industrial water supply and irrigation all over the World. In the last few decades, there has been a tremendous increase in the demand for fresh Water due to rapid growth of population and the accelerated pace of industrialization. Human Health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers and unsanitary conditions. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its over exploitation and improper waste disposal, especially in urban areas. As per the latest estimate of Central Pollution Control Board, about 29,000 million litre/day of waste water generated from class-I cities and class-II towns out of which about 45% is generated

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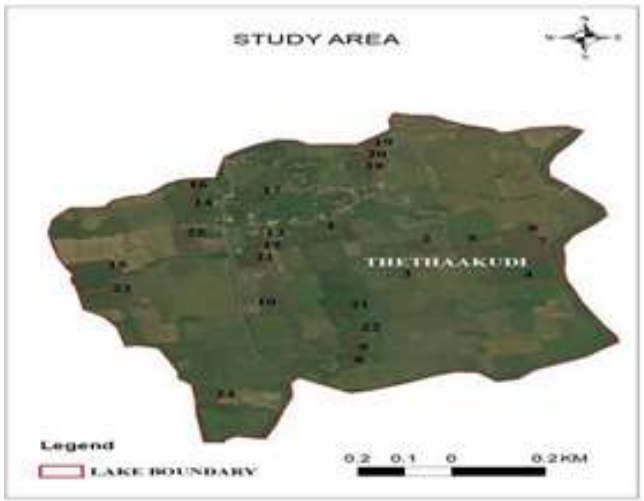
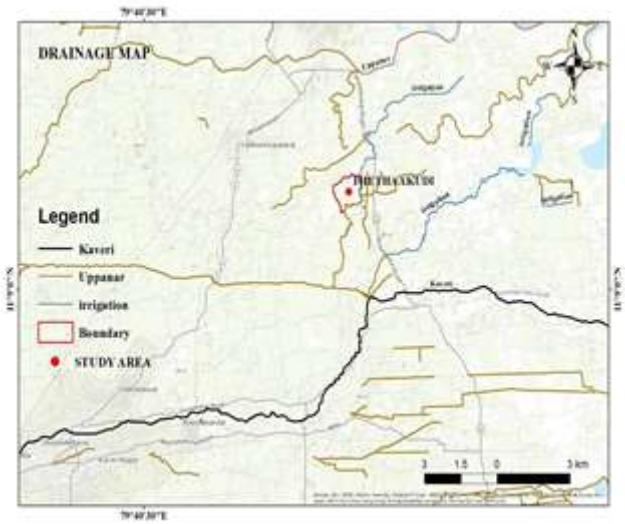
from 35 metro-cities alone (Mangukiya et al., 2012). Extreme water deficiencies have just prompted a developing number of contentions between clients (horticulture, industry)

Study Area

Thethakkudi is located at 11.23°N 79.73°E, which runs along the Kollidam River, in Sirkazhi District. Sirkazhi has an average elevation of 5.18m above sea level and is located at 13km west of Bay of Bengal. It is located 95km North-East of Thanjavur, 24km North of Mayiladuthurai and 20 kilometres South of Chidambaram. The town experiences long summers and short winters and receives an average yearly rainfall of 1,250 mm mainly from the north-east monsoon between October and December. Its close proximity to the sea means that Sirkazhi receives more rainfall than neighboring towns. Sirkazhi is part of the Cauvery delta region and has irrigation channels, called the Kollidam channels, which carry water from the rivers and provide a rich deposit of fertile silt before reaching the sea. The soil is black and contains fertile alluvial sediment.The area's main crop is rice and other crops grown in the area are coconut, tamarind and neem. The landscape mostly consists of plain lands with fields and small portions of scrub jungle. Antelope, spotted deer, wild hog, jackal and fox are present in the jungles and outlying areas of the town. Crow and ordinary game birds are found in large numbers in the town. Interlinking of water bodies involves the process of diverting surplus water through a network of canals. This innovative project will offer interlinking of local water bodies through the link water channels at micro-level in the village of Thethakkudi. Thethakkudi is a village in Mayiladuthurai district in Indian state of Tamil Nadu. The present population of the village is 358 Nos, out of these 129 are men, 141 are women and 88 are children. The village is administered by the Kathiruppu Panchayat, which covers an area of 0.98km². Thethakkudi has an average elevation of 4m and is located 11km from the coast of Bay of Bengal.





Location	Latitude	Longitude
1	11.18147	79.75017
2	11.18099	79.752
3	11.18006	79.75163
4	11.18015	79.75395
5	11.18101	79.75288
6	11.18141	79.75405
7	11.1809	79.75422
8	11.17673	79.75072
9	11.17711	79.75079
10	11.17874	79.74884
11	11.18048	79.74882
12	11.18082	79.74895
13	11.1812	79.74901
14	11.1823	79.74763
15	11.18007	79.74598
16	11.18312	79.74753
17	11.18275	79.74894
18	11.18373	79.75091
19	11.18455	79.75108
20	11.18407	79.75096
21	11.17863	79.75064
22	11.17783	79.75084
23	11.17923	79.74606
24	11.17545	79.74806
25	11.18122	79.74749

Physiography

The study area forms part of Nagapattinam, Karaikkal and Thanjavur district. It is broadly classified into: 1) Western gently undulated surface, 2) Central alluvial plains of the Cauvery delta, 3) N-S and E-W trending fluvio marine deltaic

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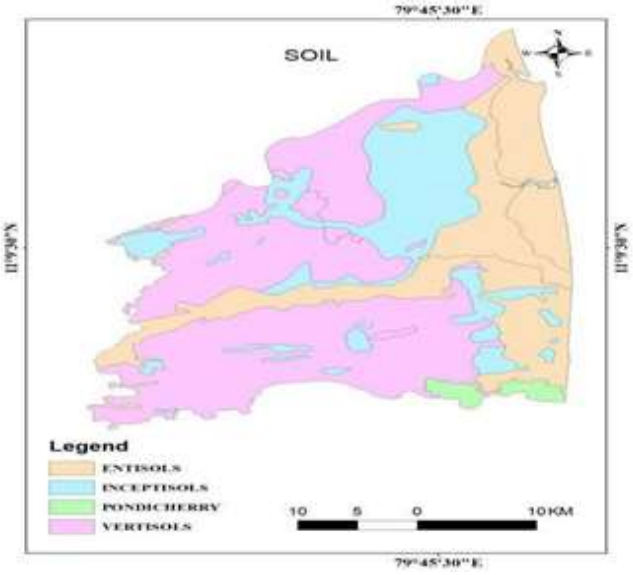
plain and 4) N-S and E-W trending coastal chenier plain between Coleroon mouth in the north, Muthupet mangroves in the southwest and Vedaranyam in the Southeast. The study area is almost gentle and sloping gradually towards east.

Geomorphology

The present geomorphic set up in the study area was the result of action of major rivers with their distinct tributaries, oscillations in the sea level, tidal effects of Bay of Bengal and forces of wind. Study area forms a part of the fertile Cauvery delta and the region is completely covered by the distributaries of Cauvery.

The maximum elevation is about 21m above mean sea level in the west. The geomorphology consists of the younger coastal plain which acts on a margin between the older coastal plain and the Bay of Bengal. Alluvial plain is noted near the coast in the northern part of the study area which extends inland. The area covers with flood plains along the river course with patches of sand dunes and paleo beach ridges near the coast. Flood banks of Cauvery and its distributaries are away from the watercourses in the upper reaches where the river is wide and closer in the lower reaches by gradually becoming narrow.



Thelandforms were divided as erosional and depositional regime. The depositional regime comprises of coastal plain under marine influence, flood plain of fluvial regime with an intermixing section of both fluvial and marine influence. The study area is covered completely by alluvium of variable thickness and the region is peneplained flat terrain having a gentle slope towards east.

Geology

The study area mainly comprises of quaternary sediments which increases towards the south of Coleroon river. These sediments have been delineated as alluvial deposit of the cauvery river and its distributaries, narrow fluviomarine deltaic plain deposits and marine coastal deposits (east coast formation). The fluvial deposits comprise flood plain, flood basin, point bar, channel bar and palaeo tidal flats with clay, sand and sand ridges or grey brown sand. The marine coastal plains include beach, tidal flats, salt marsh, mangrove swamps and deposits of sand and clay. The Cretaceous formations of the coastal tract of the Cauvery basin consist of faunal rich marine sedimentary rocks namely; limestone, sandstones, clays and sandy beds. Near the mouth of the river comprises alluvium deposits which are composed of clays and silts.

Hydrogeology

The aquifer gets stratified both horizontally and vertically resulting in extensive variation of permeability and aquifer yield. The depth of the aquifers ranges between 20.0 and30.0 m (Below Ground level) BGL and thickness ranges between 5.0- and 25.0-men compassing majority of the study area. Groundwater occurs under water table, semi-confined and confined conditions. Groundwater extraction is mainly by tube wells with depth ranging between 20 and 50 m BGL. Depth above water table in these wells varies from 0.3 to 3.3 m BGL and yield varies from 6.0 to 2460.0 LPM (litres per minute) per 6 m of drawdown (CGWB 2008). Majority of water utilities for drinking, domestic, agricultural consumption and industrial use are from these aquifers. Lithological cross section from the east to the south of the study area shows aquifers bifurcated into shallow and deep by the presence of clay formations. The aquifer is more clayey in the east and southeastern parts of the study area except the coastal stretches where the beach sands occur.

Soil

The major part of the study area is covered by black clay and isolated patches of brown clay loam bordering in the NE boundary of Karaikal. Some patches of arenaceous soils are also found along the coast line. The soil of the district is mostly alluvial but varies greatly in quality. The soil in the delta found in the Tirutturaippundi and Nagapattinam taluks were saline and arenaceous.

The maximum elevation is about 21m above mean sea level in the west. The geomorphology consists of the younger coastal plain which acts on a margin between the older coastal plain and the Bay of Bengal. Alluvial plain is noted near the coast in the northern part of the study area which extends inland. The area covers with flood plains along the river course with patches of sand dunes and paleo beach ridges near the coast. Flood banks of Cauvery and its distributaries are away from the watercourses in the upper reaches where the river is wide and closer in the lower reaches by gradually becoming narrow.

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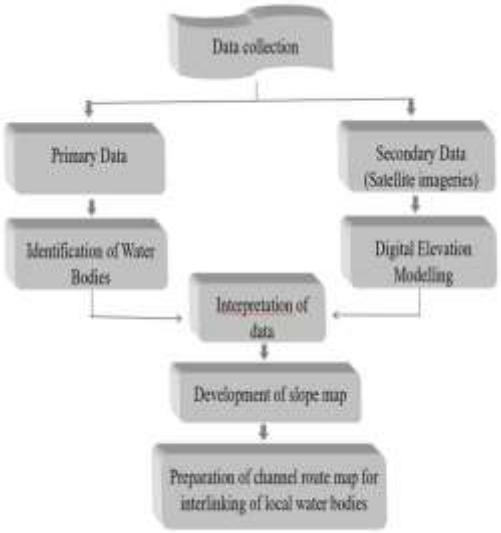
Methodology



Land Use and Land Cover

The methods adopted in the study included the use of three broad techniques, reduction in the size of pixel area, the image is moredetailed. The ground feature represented by a pixel is determined by the altitude of theremote sensor system and its design parameters, particularly the instantaneous-field of-view Conventional ground truthing techniques Mapping of the terrain, slope and aspect was carried out on a GIS domain. Conventional sampling techniques was followed for classification verification and collection of ground points. Finally, all the maps were composed in QGIS 10.4 software.

- Remote sensing
- Geographic Information System (GIS)

Digital Image

Digital images consist of discrete picture elements which are called 'pixels'. This individual pixel is associated with a number i.e. the average radiance (brightness) of are alternatively small area within an image. Size of the pixel area affects the reproduction ofdetail within a scene/data. With (IFOV).

Remote Sensing Data

For a regional level mapping and study, remote sensing data with medium spatial resolution is frequently used (Lu and Weng, 2007). However, as the study region ishighly heterogeneous which comprised of small sized land components that have agreat degree of intermixing, the utilization of relatively high spatial resolution data wasopted as best suited for the spatial assessment of the different land use land cover categories. The remotely sensed data used in different analysis and study for thischapter were procured from two different sources.

- Bhuvan Remote Sensing Centre (BRSC), Hyderabad, India.
- United States Geological Survey (USGS) Earth Explorer, United States (https://earthexplorer.usgs.gov).

For study of the spatial assessment and analysis of the same, a total of five IRSResourcesat-2 (R2) LISS-4 (Linear Imaging Self Scanning Sensor), a Landsat_OLI andfour ASTER (Advanced Space-borne Thermal Emission and Reflection Radiometer) GDEM (Global Digital Elevation Model) data was used. Care was taken during thedata selection process to ensure that all data used for the study are cloud-free in orderto avoid overestimation and for better interpretation and classification results (Agarwalet al. 2003; Suleiman et al. 2017). Details of the different satellite imageries used in thepresent study are given in Table 3.1 and 3.2

Reconnaissance Study

Barak valley area was initially studied from Google Earth Pro and through the creationof a grid base map and information obtained from ancillary data. With the aid of theseinformation and base map, primary reconnaissance survey was conducted to gatherinformation about the different land use land cover types in the field.

II. RESULT AND DISCUSSION

The present study is carried out to interlink the water bodies in Thethakudi Village. The interlinking of lake is done with the help of many primary and secondary datasets. Lake polygons are generated with the help of Google Earth Pro software. Field checking has also done for ground truth. Elevation, slope and LULC maps are prepared using QGIS 10.1 software.

Total area of the water bodies in study area is around 0.032 Km2 and the total volume is about 2000 m3. The Digital elevation map is prepared using Aster GDEM. The elevation difference in study area is from 4 to 8 m with the sloping angle of 30-50 degree. The volume of the water body is calculatedusing Global mapper software. From the slope and elevation date the flow direction is identified and the major flow in south east direction.

Prediction of Water Volume

Water potential of the study area was determined using inflow and outflow data. Measured annual inflow data from 1978 to 1999 used to generate mass curve. Demand line was generated from total outflow that including for hydro-electric power, irrigation, domestic use of water natural life in stream. Maximum difference in mass curve and demand line gives the amount of water volume which can be stored based on inflow

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data of the study area. Water volume was calculated as 2000m3. Dam crest elevation was determined based on this prediction.

III. CONCLUSIONS

The water body's reservoir capacity was determined to be 2,000 m3 and its surface area was estimated to be 0.032 km2 based on elevation data.Given that the elevation values on the digital elevation map range from 4 to 8, it appears that the study area is relatively level with a gentle slope. The utmost slope of the area is 50 degrees, and that is only along the edges of agricultural land. The area is flat, and the direction of the inclination is to the south-east.The flow orientation of the study area is south-east, and the lake is interconnected according to the stream order. The area's stream order is 1st, 2nd, and 6th order.The alignment of the canal is proposed based on hydrology, geology, and land use perspectives, and one is chosen as the most appropriate for linking lakes. The alignment takes into account factors such as the minimum distances between lakes, populated roads, agricultural lands, etc. A field survey is conducted to determine the most reliable alignment and attain the lowest gradient possible. Before determining the capacity of the canal or culvert, the water balance and overflow rate must be examined. Based on the land use map, Alignment 1 passes through agricultural lands, excluding built-up areas. The alignment must pass through agricultural land for a minimum distance. It has no gradient for gravitational flow. Currently, agricultural land has been converted to urban development. Therefore, gravitation flow is possible. This alignment passes through the urban area, thereby increasing the cost. It follows the longest route. This alignment follows a zigzag route that traverses' roads and avoids urban areas. Gravity flow is capable of attaining a minimum gradient. This alignment's advantage is that it follows the roadside; therefore, no building demolition is required, and the gradient necessary for gravity flow can be attained. The gradient and slope obtained are minimal, so a large cross-section is required.

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