Evaluation of Drainage and Surface Water Resources of Brahmayyalingam Lake in Agiripalli Mandal, Krishna District, A.P., India Using Geo-Spatial Technologies

G.T.N.Veerendra, A.V. Phani Manoj, Adari Satish Kumar, Pallepamula Urmila

ABSTRACT--- The water assets preservation and management assumes an essential part in the financial advancement of a country. In view of water need and the idea of improvement of water assets on watershed evidence has picked up significantly over the most recent two decades. The expanding request set on them has empowered examinations, situated towards the assessment of the assets, which is the reason for the detailing of plans for its investigation, administration, and preservation. The protection, improvement, and administration of surface water assets raise the generation level and maintain the same, it is conceivable through watershed-based projects. The Brahmayyalingam Lake is the geohydrological framework is a vital piece of Budameeru waterway of Kolleru basin. It is exceptionally impossible to miss to take note of that this geohydrological structure is subjecting to visit flooding amid rainstorm and intense water shortage issues amid whatever remains of the year. The principal target of the present paper is to create spatial data on water and surface water assets in Brahmayyalingam lake watershed. Geospatial advancements that incorporate Remote sensing and GIS will be utilized for creating data base on water and surface water bodies, the required information consolidates satellite pictures and other subordinate information as Survey of India (SOI) toposheets, reports, small scale maps, ground truth/field information and so forth.

Index Terms—
GIS - Geographical Information Systems, SOI- Survey of India, SRTM - Shuttle Radar Terrain Mapper

I. INTRODUCTION

According to recent studies it was identified that, globally, natural resources are going under severe threaten the present circumstances [Bronmark.C et.al, 2002]. The increasing anthropogenic activities pose severe pressure on various natural resources, together with forest and water resources [Bonell.M et.al, 2004]. The running down of these resources have an impact on micro climate state of region transforming the existing natural landscapes into undesirable land structures unsuitable for use [Hofer.T et.al,1993].The fall and loss of water storage potentialities like tanks, canals etc., are at the same rate at which forests are dishonored since water is noted as the crucial & critical constituent necessary for individual utilization also with agricultural usage, safety, management and protection of these assets are decisive for the sustainability of habitants .[Johnson et.al,2001].

1.1 Remote Sensing:

Remote sensing is the acquiring of information about an surface object without having physical contact with the object and thus in difference to on site study.

PROCESS OF RS

Remote sensing is another category of geography. In present technology usage, the term generally refers to the use of above ground sensor technologies to spot and categorize objects on Earth by means of disseminated signals (e.g. EMR). It may be split into active remote or passive (e.g. sunlight) when information is purely witnessed.

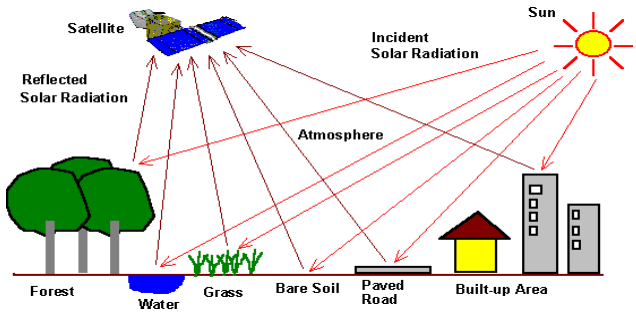

Figure 1 Process of Remote Sensors

Passive sensors assemble radiation that is emitted or reflected by the entity or neighbouring vicinity's. Reflected sunlight is the most familiar resource of radiation measured by the sensors, examples consist of infrared and radiometers.

1.2 Geographic Information System:

A GIS is an automated based tool for mapping and evaluating features on earth. GIS innovation amalgamates across the board database methods, for example, enquiry and factual examination, with maps. GIS oversees area based data and gives instruments to show and examination of different measurements, including populace qualities, monetary advancement openings, and vegetation composes. GIS enables you to connect databases and maps to make dynamic showcases. Additionally, it provides tools to visualize, certainty, and overlay of those databases in certain ways that are not possible with conventional spreadsheets. These abilities differentiate GIS from other information systems, and make it valuable to an extensive choice of

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G.T.N. Veerendra, Assistant Professor, Department of Civil Engineering, Gudlavalleru Engineering College, AP, India. (E-mail: tarakaveerendra@gmail.com)
A.V.Phani Manoj, Assistant Professor, Department of Civil Engineering, Gudlavalleru Engineering College, AP, India (E-mail: phanimanoj.akula@gmail.com)
Adari Satish Kumar, Assistant Professor, Civil Engineering Department, Aditya Engineeering College, AP, India (E-mail: suryasatish111@gmail.com)
Pallepamula Urmila Assistant Professor, Department of Civil Engineering, NRI Institute of Technology, AP, India (E-mail: pallepamula.urmila@gmail.com)

public and private enterprise for explaining events, prediction of possible base line answers and planning approach.

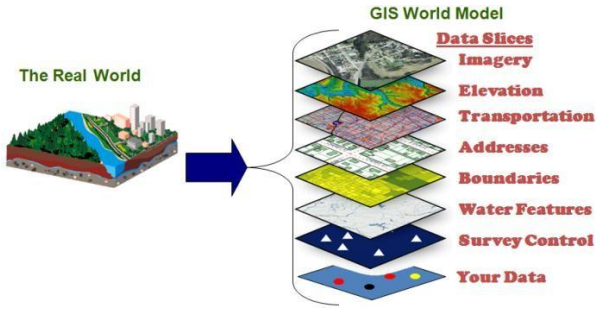

Figure 2 Collection of data from real world in to toposheets

A GIS will, in general, have a means of inputting data in to a data base, editing the data, displaying information stored in the data base, and performing certain calculations including sorting of the data in the data base. The nature of the data stored and the analytical and modelling capacity of a GIS will determine solution to particular problems related to floods or land use planning or other potential needs

1.3 Objective:

Objective of the paper is

- To generate spatial information on drainage and surface water resources in Brahmayyalingam lake watershed.
- Collection ancillary data in the form of Survey of India topo sheets, reports, small scale maps, ground truth / field data etc.
- Integrated analysis of these parameters will be employed in thoroughly addressing the present status of study
- Remedial Solutions can be suggested referring the problems to safe guard the lake eco system.

1.4 Study Area:

The current study area, Brahmayyalingam is the lake & named after the supernatural being "Brahmalinga's" idol located at temple near by the lake. It is the biggest minor irrigation tank in Krishna district. The inflow in to the lake is mainly due to the channel called Kumpini vagu. Geographically the lake latitude is 16°37'24" and 16°39'18" followed by the longitude is 80°47'06" and 80°49'50" respectively.

The Brahmayyalingam Lake extends linking Thotapalli and Narasingapalem panchayats of Agiripalli mandal (next to Gannavaram) Krishna district. It is situated at 12km from Gannavaram mandal figure 3 illustrates the location of the lake. The total area of Brahmayyalingam Lake is 1064acres and there is a twin tank by name Sagguru amani tank, with a water spread area of 200 acres located by the side of Brahmayyalingam tank. The lake is located at the middle of the small mountains addition with abundant vegetation. The lake does not have any remarkable points of confinement, but instead is regularly obliged by inclines and mountains. Sightseer can have the lake appearance as a huge tank as a significant water body with intangible points of confinement. The water structure was under the Minor Irrigation division attached to a joint exertion with the local gram panchayat of Chikkavaram town. Valid previous records illustrates the lake's water degree to be around 600 ha, yet starting at now it is diminished to approximately 430 ha. The forepart shore area is around 405 ha arranged in 4 towns, viz., Chikkavaram, Metlapalle, Thotapalle and Narsingapalem. The lake's created immersed an area is 928 ha and it has a limit utmost of 8.34 x 106 m^3, enrolled zone for water framework under this lake is around 846 ha consisting both chikkavaram and metlapalle of Gannavaram Mandal. The combined catchment area under this lake is around 155 km2. Further, as indicated by our diagram with adjacent individual's receding the lake region, around 12 towns use this water of this lake for their cultivating and neighborhood needs. The lake water servers basically for water framework, beside Pisciculture and nearby use (consumable). Paddy is the rule trim under this current lake's water framework and the yearly wage created by improvement of this item is in the demand of US$ 0.86 million. The inflow into the lake is fundamentally through a little channel called "Kumpani Vagu". In addition, precipitation and other water from the enveloping streams slant in like manner drain into this lake. Occupants of close-by regions remark that the lake withstand with water even in the summer season and the likelihood of becoming scarce happens just when there is less precipitation or constant dry times of at least three years. No settlements were found in the quick region of the lake, Perhaps this could be the purpose behind the un-dirtied state of the lake. In and around 30 towns were rely upon this lake water for their development, Agricultural and local purposes

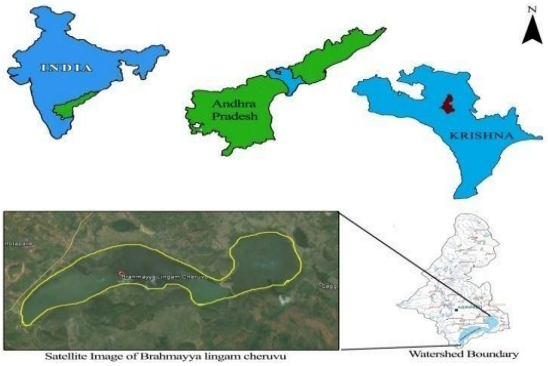

Figure 3 Map showing Location of Brahma lingam Lake

1.5 Input Data

The input data required for mapping of study area are

1.Collateral data

2. Satellite data

1.Collateral data:

SOI toposheets of 1:5000 have been used for digitization of drainage, surface water bodies settlements, isohytal map, slope map and transport map. This figure 2 represents the

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watershed Index area that have going to be digitized in that toposheets D9,D10, D13 and D14.

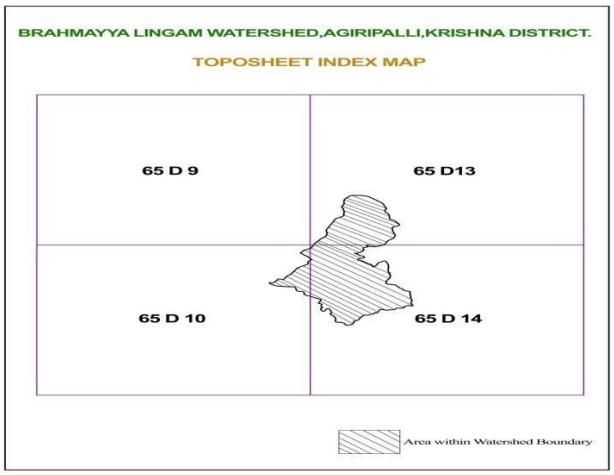


Figure 2 Watershed index.

2. Satellite data:

LISS-IV satellite data and geo coded photographic products on 1:5000 scale has been used to update the mapping details of settlements, transport network, Isohytal map, Slope map, Drainage and surface water bodies. Satellite data with high resolution are definite by spatial resolution of about limited number of meters. These data are often obtained simultaneously in panchromatic and multispectral methodology with significant influence of spectral bands wrapping with infrared optical range. Few satellites achieve the data entirely in required standard form. On the other had other more up-to-date satellites can take data as per the stick of intrigue. In the two cases far reaching information gathering are available containing every one of the pictures obtained since the dispatch of the satellite data drawn from LISS IV MX covering the study area as shown in the figure 4. The information are appropriate for mapping of maps. The information are appropriate for mapping or refreshing of maps in the scale run 1:100,000-1:25000.

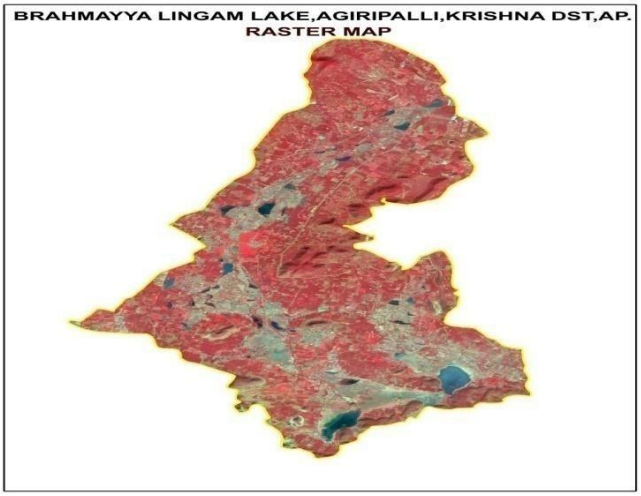


Figure 4 LISS IV MX Satellite data of Watershed Boundary

II. LITERATURE REVIEW

*2.1 **Drainage**:*

A Drainage basin is a region of land where surface water from rain, ice combines to a solitary point at a inferior elevation, for the most component the exit of the basin, where the water join another water body, for illustration, a stream, lake, supply (or) sea. This seepage basin goes about as a pipe by gathering all the water with in region secured by the basin and diverting it to a solitary point. The primary motivation behind waste framework in Geomorphology the example shaped by the streams, waterways and lakes in a specific seepage basin. In farming an intercession control waterlogging going for soil change for agrarian creation. A seepage framework in urban and modern zones, an office to discard fluid waste. In association with our ebb and flow consider past investigations led by Sarita Gajbhiye (2015) to distinguish the waste example of shakkar waterway in chhindi town, Madhya Pradesh the outline of the Shakkar stream catchment and planning of seepage delineate in light of geo-coded Digital Elevation Model (DEM) created from SRTM. Another investigation by Horton's (1945) & Strahler (1964) at long last presumed that, the waste example will change to dendritic to sub dendritic because of deviations in slant and geology. Figure 5 demonstrates the created guide of waste in the watershed.

S.no	Watershed basin	Basin area(km^2)	Total stream length (km)
1	WS-1	30.215	79.48(23.1)
2	WS-2	49.17	92.6(26.9)
3	WS-3	90.545	171.65(49.9)
Total			343.73(100.00)

Table 1. Watershed basin with length

S.no	Watershed basin	Drainage density	Stream frequency
1	WS-1	0.46	0.43
2	WS-2	0.54	0.53
3	WS-3	1.01	1.02
Brahmayyalingam lake basin		0.67	0.66

Table 2 Areal aspects of morphological parameters

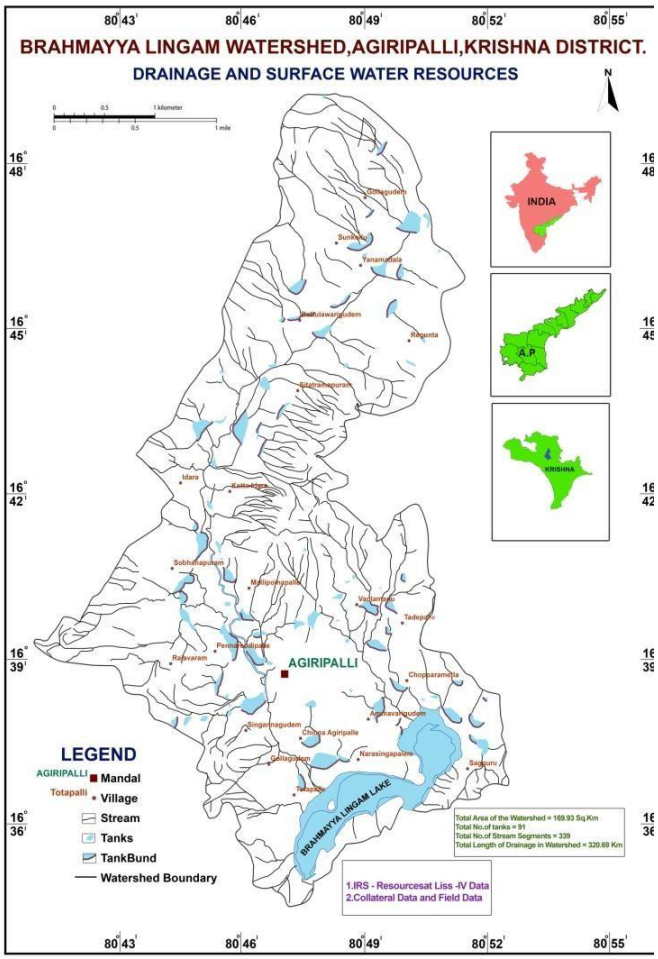


Figure 5. Drainage and Surface water resources Map

2.2 Isohytal Data

The current study of Brahmayyalingam Lake has a lower rainfall data and it ranges between 1050-1100mm. In arrangement with suitable rainfall-flow models, the geospatial advances give perfect apparatuses to the assessment of straight spread out quantity, top streams and hydrographs. For the most part, RS information give a supply of information parameters for the models in stream estimation. Topical all together ashore utilize, soil, vegetation, seepage, and so on topographic parameters (zone, elevation and angle) which aggregate with customarily figured climatic parameters (precipitation, temperature, and so on.),compose the necessary input data for The surrounding areas of Brahmayyalingam lake

Figure 6 Brahmayyalingam lake if rainfall exists

In December 2010, figure 6 the rainfall is present in this lake and the lake is totally covered with full of water and vegetation. The lake water is preserve in first-class eminence with no outlines of contamination in the water. The total rainfall in watershed covers an area of 169.93 km2 and the average rainfall is 856mm. Plotting of Isohytal map is done by collecting the data from Directorate of Economics and Statistics, Andhra pradesh from 1996 to 2015. The below table shows the annual rainfall of the Agiripalli mandal and Gannavaram mandal in Krishna dt.

Table 3 Rainfall data of Agiripalli and Gannavaram mandals

Name of the mandal	Avg of 1996-2009 (mm)	In 2010 (mm)	In 2011 (mm)	In 2012 (mm)	In 2013 (mm)	In 2014 (mm)	Avg of 1996-2014 (mm)	Avg of 2009-2014 (mm)
Agiripalli	922.5	1278.0	1027.0	1715.33	1110.4	641.3	1038.4	1154.4
Gannavaram	1155.7	2121.6	1102.8	2020.4	1866.2	611.7	1350.1	1544.5

The villages near Brahmayyalingam lake are Agiripalli and totapalli and around 30 other villages are present. In and around Brahmayyalingam lake, surrounding villages the highest rainfall is in tivvuru and visannapeta is 1388.8mm. From figure 12 the agiripalli total annual rainfall is in between 1050-1100mm.The surrounding villages near Agiripalli mandal the average annual rainfall is in between 1100-1250mm. It represents the average rainfall in this place. But so many villages are depending on this lake for Agricultural, Irrigation and Domestic purposes. Fig 7 illustrates about rain fall distribution in the watershed area, If the water is present in this lake there is no problem for the surrounding people they use this water for their needs and the rainfall is the only source for this lake.

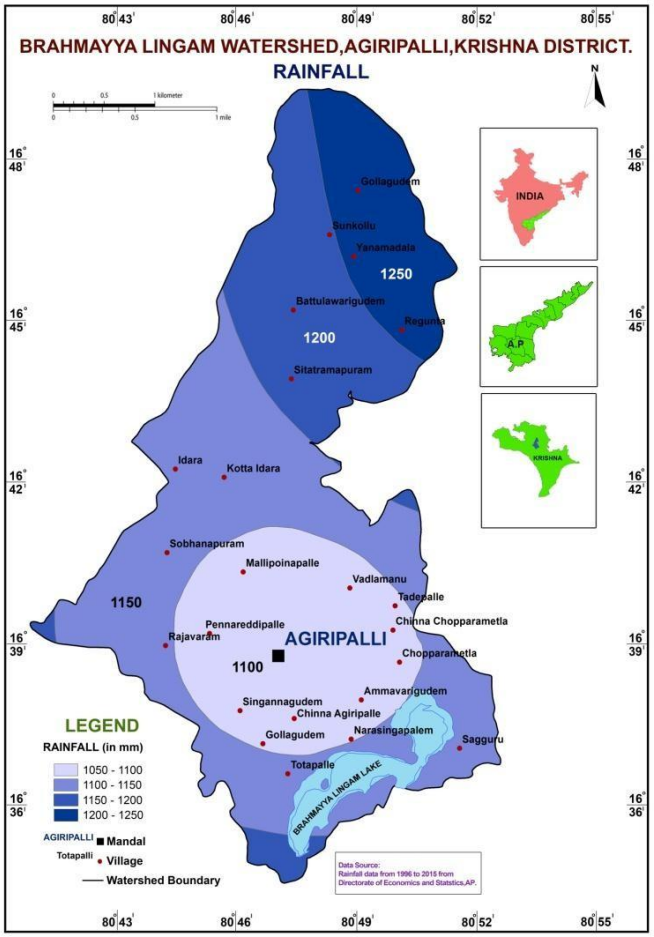


Figure 7. Rainfall Statics Map

2.3 Slope map

The LISS-IV IRS P6 spatial resolution is used to generate 1:10 000 scaled Digital Elevation Model (DEM) of Brahmayyalingam cheruvu to determine the flow accumulation and direction of stream using both RS techniques and GIS. DEMs should be cleared of pits or ponds, where water gathers when drainage network is extracted, before being used in the hydrological modelling [Ashe.R, 2003]. Using an algorithm known as sink filling a sign of errors, pits, can be removed from DEMs.

After removing the inaccuracy by nourishing basins procedure, by conniving the sharpest slope and by encoding into each cell for possible flow directions toward the adjacent cells a flow path map is produced. Then flow direction is used to produce the flow accumulation map by address each cell of the DEM, counting how many upstream cells donate to flow throughout the given cell. After all, both flow addition and flow direction maps are used to generate synthetic drainage system of the basin. In table 4 represents the final slope values of the Brahmayyalingam lake by using GIS software.

Table 4 Slopes with their areas

Slope Classification	Area(km^2)
Slope type -1	89.76
Slope type -2	59.48
Slope type -3	4.17
Slope type -4	0.36
Slope type -5	0.29
Slope type -6	1.29
Slope type -7	14.58
Total	169.93

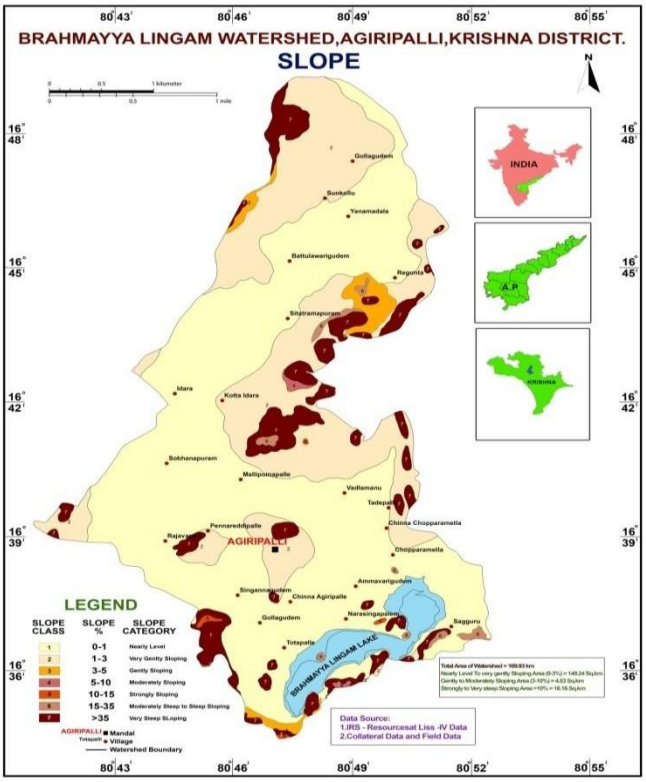


Figure 8. Slope Map

From figure 8 the slope existing near Brahmayyalingam lake is very gently sloping of 0-3% containing an area of 149.24 sq.km, 3-10% containing an area of 4.53 sq.km and it represents the gently to moderately sloping area and >10% containing an area of 16.16 sq.km and it is strongly to very steep sloping area. The maximum sloping of an area are gently sloping in Brahmayyalingam Lake. The figure 6 represents the sloping condition of lake. The slope is 10m above the mean sea level. These slopes are drawn by considering the slope from highest point to lowest point and in this area the number of slopes is more due to surrounding hilly areas. From this figure 13 it represents the 88% area containing the gently sloping area and the 3% containing the moderately sloping area and 9% containing the steep sloping area.

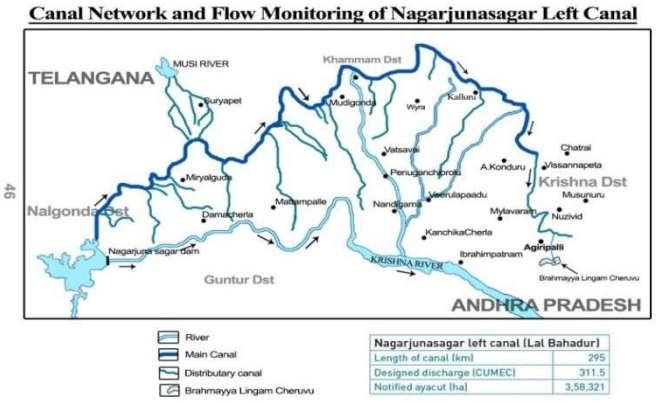
In this figure 8 if the slope % is in between 0-1% then the slope is nearly level if the slope % is in between 1-3% then the slope is very gently sloping, if the slope is in between 3-5% then the slope is gently sloping, the slope is in between 5-10% then the slope is moderately sloping, if the slope is in

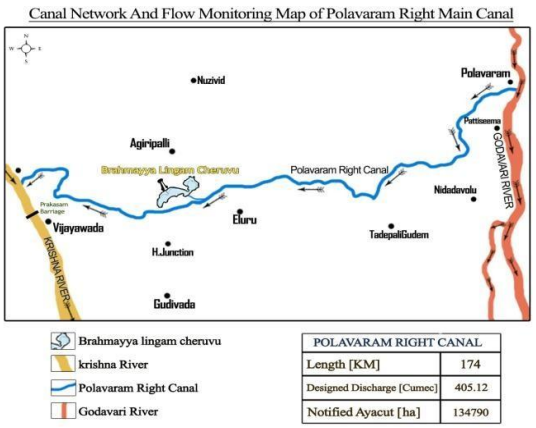
between 10-15% then the slope is strongly sloping if the slope is in between 15-35% then the slope is moderately to steep sloping and if the slope is >35% then the slope is very steep sloping then regarding to our current study mostly the slope around this lake is gently sloping and 9% containing the steep sloping area and the 3% containing the moderately sloping area. These slopes are formed due to the hills around this Brahmayyalingam lake. Due to this slopes if the rainfall exist most of the water are joined in this lake.

III. CONCLUSION:

In the current study and after rigors field surveys had concluded that, rainfall is the only source for stagnation of water in the lake and considered as a live source for domestic needs for the surrounding villages. With reference to the rainfall statistics, from last 5years had decreases drastically, due to the global warming and manmade actions such as deforestation and imbalance of eco-system around the region. The average rainfall of the region is 856mm. Field visit and surveys had identified that the present storage capacity of Brahmayyalingam Lake is 2TMC, after keen investigation of soil and the region, it is recommended to increase the storage capacity by excavating the area. Paddy is the main crop cultivated under this lake's irrigation, Around 9000acres of land were irrigated depending on the Brahmayyalingam lake water, the present situation it may get worse and the surface water bodies near to this lake is kumpini vagu. The absence of Rainfall in this region may lead to water scarcity.

After all the observations the following are the suggested diversions from Nagarjunasagar left canal & Polavaram Right main canal were recommended to keep the lake in live.





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