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Site selection and evaluation of constructed wetland site

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Abstract— In the 21st century water crisis has been the biggest crisis faced amongst most of the countries .Water Pollution is one of the factors contributing to water crisis. Though the 70% of earth is water many parts of the earth are devoid of water because of Water Pollution .So there is a serious need of finding a new efficient, practical and economic way of treating polluted water so that it can be used for secondary works. In Big cities the waste water coming out of wash basins and kitchen sinks is found to be less dangerous and can be treated with new Wetlands Technology and can be reused for the secondary purposes like gardening, car washing etc. Methodology includes the Creation of database, finding suitable location for the wetlands in a particular area using GIS background and types of wetlands suitable for particular location. It gives a methodology to find the suitability or non-suitability of wetlands in particular area for particular quantity and quality of water, source and also provides the Cost Time Space comparison of the various treatment methods. Use of Data Information System (DIS) and GIS data enables user a cost effective, convenient and appropriate method of Detection of Wetland Site interpreted in terms of Raster Maps. The study includes the analysis of study area having known attributes and analysis of study area having unknown attributes. This study describes the Evolved methodology for the Detection and Monitoring System of the Wetland System on selected study area.

Key words: GIS, Data Information System, Wetland , Reuse, Recycle ,Wetland filter cartridge

I. INTRODUCTION

1.1Problem Definition

It is needed to understand the necessity of use of potable water at the right place for the primary activities like drinking, cooking, etc. for the secondary activities like gardening, car wash the potable water shall not be wasted but the treated wastewater shall be used. Problem is to be solved by sticking to the principle of reuse and recycle and finding out new alternative for the treatment of wastewater.

1.2 Scope of Project

- Design of Data Information System for wastewater source
- Wetland & wetland types
- Virtual representation of DIS in GIS environment
- Development of priority map using DIS & GIS
- Development of Quality status Matrix for various types of buildings using quantitative survey.

1.3 Objectives

The main objective of the present study is to study the different types of wetlands and find out its suitability at particular area using the GIS and find out the suitable land for the constructed wetlands using the same.

- Development of methodology for the detection of suitable site for the wetland construction using GIS.
- Development of a portable wetland cartridge which can be placed in the existing wastewater flow network so as to treat the wastewater.
- Development of DIS tool in GIS environment
- Addition of more GIS based queries for wetland types

II. METHODOLOGY

The GIS tool can be used as decision making tool for the selection of suitable site for the constructed wetlands. The primary focus is the performance-based design algorithms. The Methodology involves the suitability of the type of wetland to be constructed on a particular piece of using the GIS softwares.

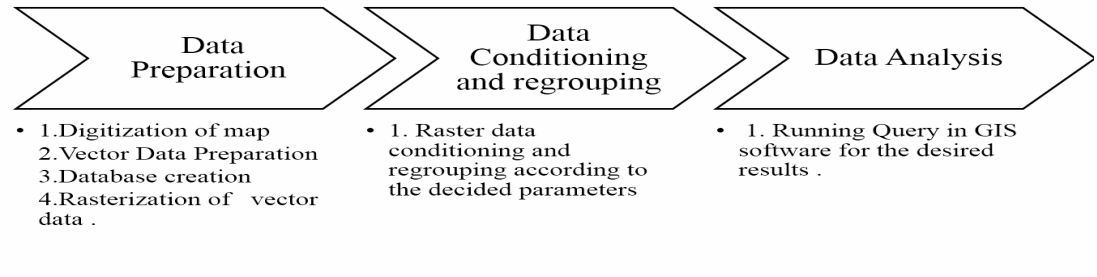

Fig 1. Methodology

III. CASE STUDY

Nasik city is situated on East side of Western mountain range on the banks of River Godavari and its tributaries. Sub-channels of river Godavari are spread throughout the Nashik Municipal Corporation area. Geographical location of Nashik is 20 01' to 20 02' North Latitude and 7330' to7350' East Longitude. Nasik city is situated on both the banks of river Godavari and extends east west along the banks of river and its sub-tributaries. Total area of Nasik Municipal Corporation is 264.23 sq.km and height from M.S.L is 101 mt. Population of Nashik city is 14.86 lakhs (census 2011).

Data preparation

Vector Data Preparation

The vector data is prepared and the vector map is georegistered with UTM projection and WGS84 as spheroid parameter. To achieve the aim of analysis of unknown area for the suitability of constructed wetlands, the data is to be collected in the vector format which is converted to raster format for the analysis purpose.

Precautions taken for data preparation

It is observed that the program gives accurate results under following adopted methodology.4

1. The pixel size of the all raster files which are used for analysis should be same.
2. The projections (UTM, Polyconic) of generated vector data should be same for every file used for analysis; if it's not same it should be brought under same projection using Re-Register option.
3. In the database creation step the name of the vector layer should be same as the name of the table.

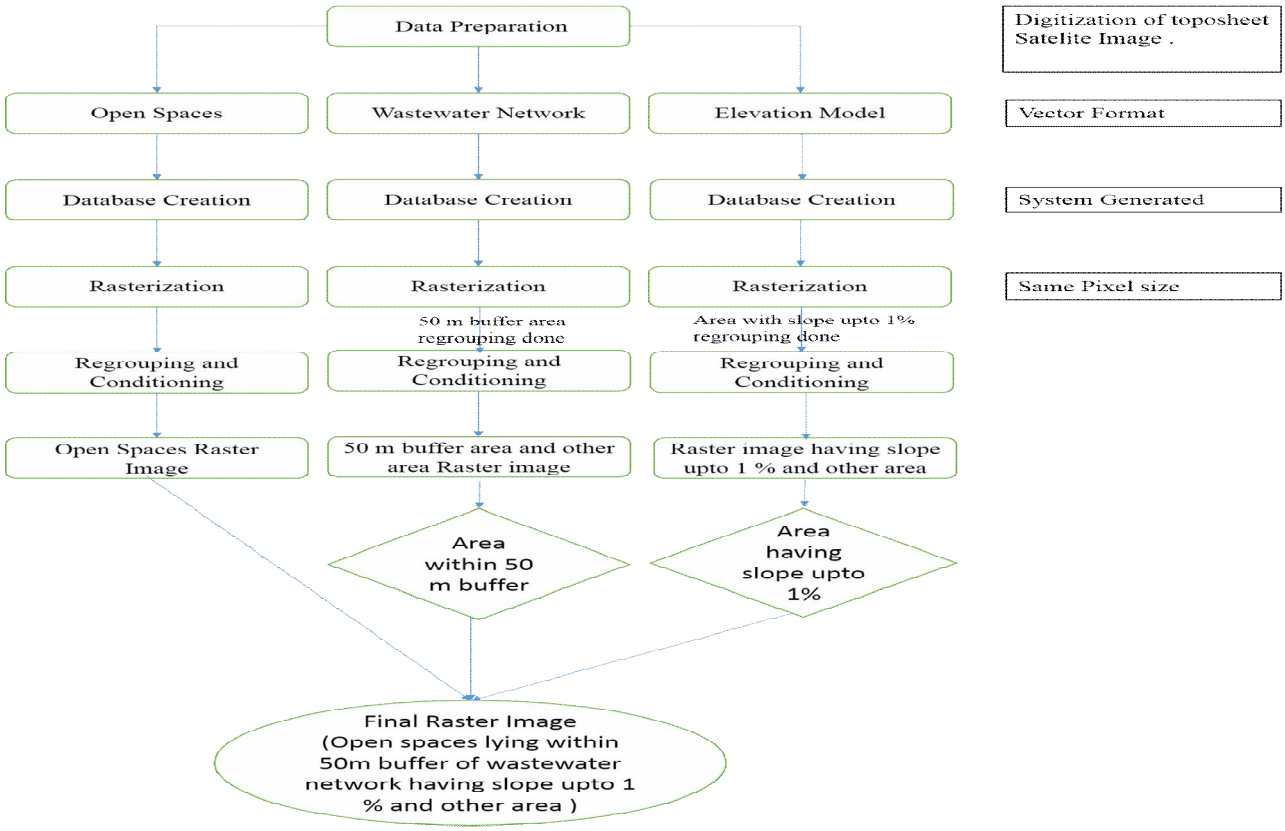

Fig 2.vector data of elevation model

Final stage

Data Regrouping and conditioning

The step after the data preparation involves the regrouping of the data and preparing the separate raster images with the decided factors. For finding suitability of constructed wetlands the following raster images were prepared for after data conditioning and regrouping.

1. Wastewater network buffer (50 m)
2. Elevation model (1 % elevation)
3. Open spaces.

The following results obtained after regrouping and conditioning of data. (fig 5, fig6)

Data Analysis

Once the raster data preparation is completed, to find the suitable location for constructed wetlands arithmetic analysis of data is done. The vector to raster conversion (as shown infig3,4,5) assigns different a unique pixel value for the each

and every color shown in legend . The arithmetic query is run in the raster analysis module so as to arithmetical analysis of the raster data based on the pixel value. The final data required is regrouped and conditioned in the above step.

4.3.2 Database creation

The system generates the default database in the form of .mdb file. The default database is shown :

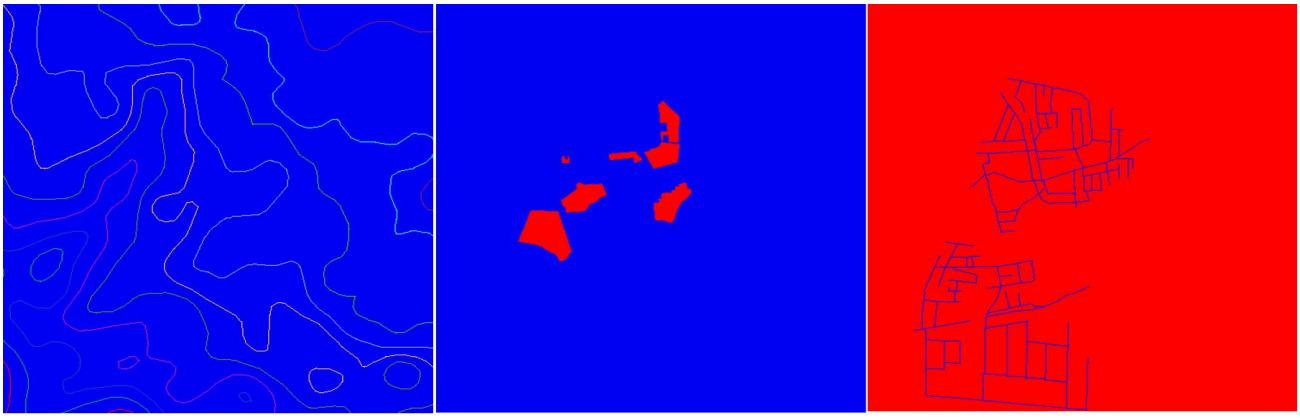

Fig.3 UnConditioned Raster Data of Elevation Model ,Open Spaces and Wastewater Network

Hanuman

SID	UID	SEG_LEN	START_PT_X	END_PT_X	START_PT_Y	END_PT_Y	Roads
15	1	129.8071	365557.46875	365565	2212222.75	2212352.25	1
14	1	0.2519456	365666.25	365666.28125	2212341	2212341.25	1
13	1	101.877	365565	365666.28125	2212352.25	2212341.25	1
12	1	251.2606	365666.28125	365668.59375	2212341.25	2212592.5	1
11	1	82.92899	365666.28125	365748.84375	2212341.25	2212333.5	1
10	1	84.65582	365748.84375	365832.84375	2212333.5	2212323	1
9	1	1.251562	365832.78125	365832.84375	2212321.75	2212323	1
8	1	221.4247	365832.84375	365926.6875	2212323	2212183.75	1
7	1	3	365926.6875	365926.6875	2212183.75	2212180.75	1
6	1	289.2129	365927.5625	365938.65625	2212311	2212600	1
5	1	4.751645	365748.71875	365748.84375	2212328.75	2212333.5	1
4	1	176.5771	365748.84375	365754.0625	2212333.5	2212510	1
3	1	226.0215	365573.0625	365565	2212574	2212352.25	1
2	1	287.502	365754.0625	365573.0625	2212510	2212574	1
1	1	1.5	365565	365565	2212352.25	2212350.75	1
31	1	238.059	365390.34375	365390.09375	2212407	2212512.75	1
30	1	105.7503	365390.34375	365390.09375	2212407	2212512.75	1
29	1	115.9955	365308.0625	365390.34375	2212378.5	2212407	1
28	1	143.5167	365308.0625	365305.875	2212378.5	2212522	1
27	1	84.7252	365390.09375	365305.875	2212512.75	2212522	1
26	1	54.23435	365305.875	365297.75	2212522	2212574	1
25	1	141.6444	365297.75	365299.78125	2212574	2212713.75	1

Record: 1 of 164 | No Filter | Search

Fig 4 Default database for wastewater network

restricted

SID	UID	SEG_LEN	START_PT_X	END_PT_X	START_PT_Y	END_PT_Y
9	590	684.5859	366939.75	366939.75	2213031.5	2213434.75
8	585	203.7998	366939.75	366939.75	2213158.75	2213316.5
7	585	824.4459	366939.75	366325.375	2214027.75	2214170.25
6	620	151.9814	366140.15625	366140.15625	2212225.75	2212225.75
5	615	245.4871	365651.375	365651.375	2212420.25	2212420.25
4	615	3089.462	366240.78125	365051.8125	2212163.75	2213134.25
3	610	457.3618	366883.0625	366883.0625	2212343	2212343
2	610	3749.11	366576.625	365051.8125	2212163.75	2213328
1	610	164.1162	366939.75	366783.125	2212206.5	2212163.75
15	605	426.6588	366542.4375	366542.4375	2212342	2212342
14	605	4839.999	366939.75	365051.8125	2212387.5	2214158.75
13	600	4297.909	366939.75	365197.84375	2212481.25	2214170.25
12	595	2707.969	366939.75	365477.375	2212606.75	2214170.25
11	590	338.6779	365907.25	365732.1875	2214170.25	2214170.25
10	590	1474.885	366939.75	366117.84375	2213503.75	2214170.25
18	630	264.4559	365065.65625	365051.8125	2212163.75	2212418
17	630	118.0084	365623.125	365511.84375	2212163.75	2212163.75
16	625	471.9267	365313.625	365313.625	2212939.25	2212939.25
22	625	40.13034	365051.8125	365051.8125	2212832	2212871.25
21	625	390.9786	365150.15625	365051.8125	2212163.75	2212519.75
20	625	424.9952	365696.03125	365310.9375	2212163.75	2212163.75
19	620	2166.403	365757.15625	365051.8125	2212163.75	2212964.25

Record: 1 of 22 | No Filter | Search

Fig5 Default database for elevation model

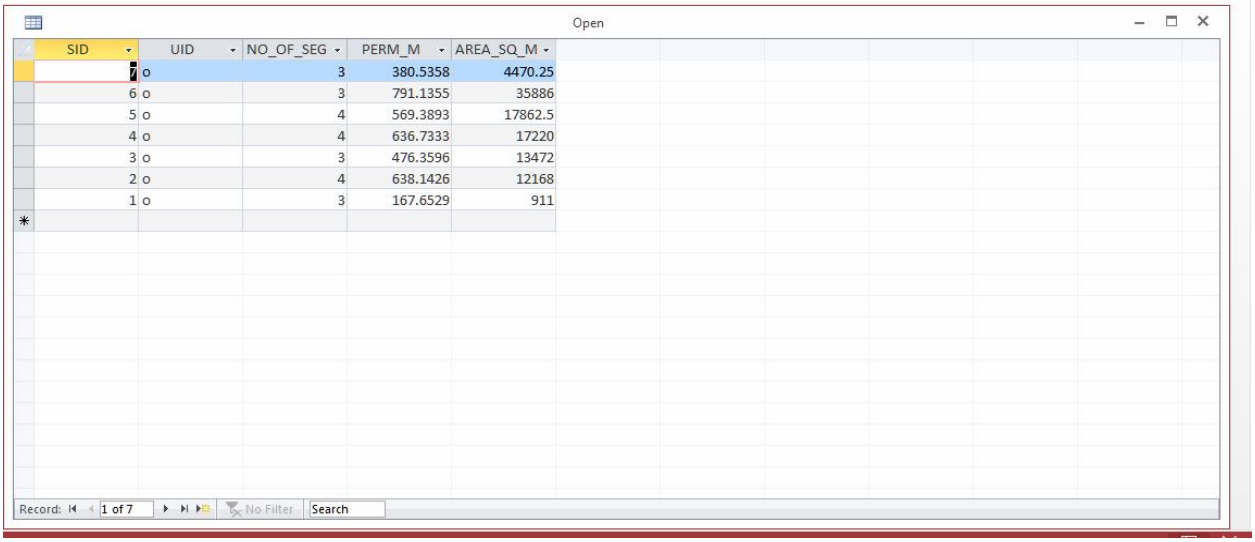

Fig6 Default database for open spaces

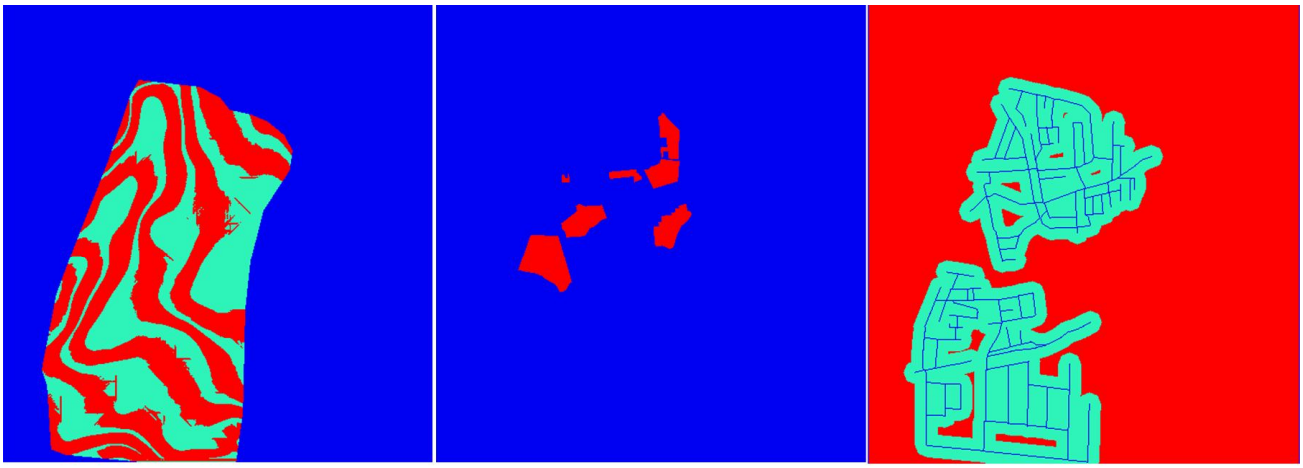

Fig.7 Conditioned Raster Data of Elevation Model ,Open Spaces and Wastewater Network

The Final Analysis is done based on the pixel value . The query used here for the analysis of data based on raster image is Query : {If ((Land use having Open spaces) and (Elevation model having slope up to 1%) and (The area which lies inside the buffer of 50 m from the wastewater network)) = (Suitable Area) else (it is unsuitable area) } = Result Using the above stated logic the arithmetic analysis of the prepared raster data is done and the final result is obtained as shown fig 12

IV. RESULTS AND DISCUSSION

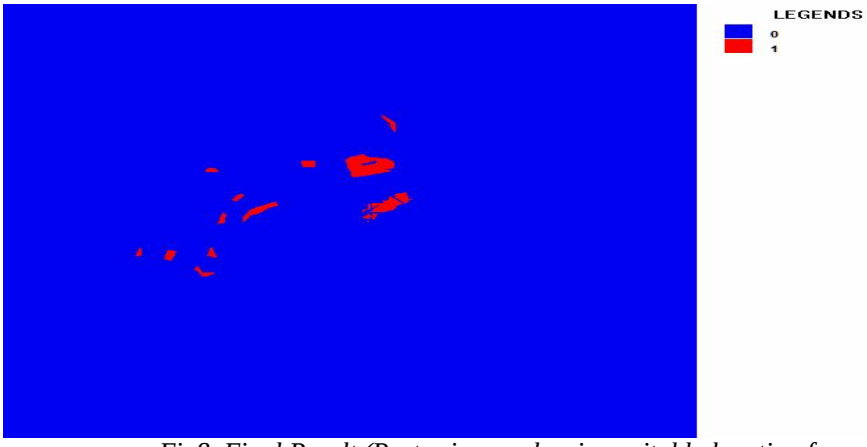

Fig8 Final Result (Raster image showing suitable location for constructed wetlands) .

V. CONCLUSIONS

1. The current study demonstrates integration of data from flood map and land use map in GIS.
2. The current study represents methodology of detection of suitable site for constructed wetlands
3. The recognition of exposure component facilitates the understanding of flood risks because it un In order to deal with the growing water demand the Water Recycling and Reuse are key options available.
4. Constructed wetland is one of most suitable method for the wastewater treatment in small communities.
5. The advantages of Constructed wetlands include the Cost Effective treatment plant, simplicity, aesthetic value , revenue generation etc.
6. G.Baskar (2010) has concluded that the wetlands is the best waste water treatment solution for the small communities.[1]
7. Constructed wetland is suitable for cluster of buildings with spatial variation of the source
8. Gis is the most suitable tool to address spatial and temporal variation in data in Data
9. Management System.
10. GIS environment can be used as Selection, Development and Evaluation tool.

REFERENCES

1. M.Deepak Low cost dairy wastewater treatment by using Constructed wetland ,Volume 2012-13,page19
2. Gram++ , Bhugol GIS , IIT Mumbai .