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Watershed Management - A Case Study of Bindusara River

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Abstract: Bindusara is a small river situated in the district of Beed in Maharashtra state of India. Bendsura River flows from south to north and meets Sindphana River, about 10 km north of Beed town. Total length of the river is about 40 km. It is a tributary river of Sindphana and a sub-tributary of Godavari River. Bindusara originates in the hills of Balaghat near the village Waghira, in south of district Beed in Patodataluqa. It is a hilly area. Various small streams contributes to the river. The city of Beed is situated on the banks of Bindusara River. Bindsura is a rapid and seasonal river. A reservoir; Bendsura Project (capacity 7.106 million cubic metres) was constructed on the river in 1955 near the village of Pāli, about 10 km south of Beed. At some places the river is narrow and looks like a stream. The lack of vegetation and rocky and undulating terrain contributes to violent floods in heavy rains. These have repeatedly caused substantial loss of property and life in the history of Beed town, most recently on July 23, 1989, when a massive flooding of three habitations in the town caused a number of dead or missing and property losses of millions of rupees.

Keywords: Engineering measures, Watershed management techniques, ground water storage, Geographic information system

I. INTRODUCTION

Watershed can be defined as the drainage basin or catchment area of particular stream or river simply it refers to the area from where the water to a particular drainage system, like a river or stream, comes from. Watershed development refers to the conservation regeneration & the judicious use of all the resources natural (land, water, plants, animals) & human with in a particular waters shed. Watershed management means the process of creating and implementing plans, programs and projects to sustain and enhance watershed functions that affect the plant, animal and human communities within a watershed boundary. Watershed management is not so much about managing natural resources, but about managing human activity as it affects these resources. The drainage area of the river provides the natural boundary for managing and mitigating human and environmental interactions. Because human activity includes actions by governments, municipalities, industries, and landowners, watershed management must be a co-operative effort.

Effective watershed management can prevent community water shortages, poor water quality, flooding and erosion. The expense of undertaking watershed management is far less than the cost of future remediation. For development of agriculture and drinking water resources the basic elements required are land and water. Because of tremendous rise in population, urbanization, industrialization and agriculture area, resulting in steep incline water demand line. Indian agriculture sector is lot more depend upon the monsoon. But last 3-4 years due to inadequate rainfall, people are looking towards the underground water as alternative sources without regarding to its recharge resulting in deepening of ground water table 100-200 m below the ground surface. Geographic information system (GIS) an essential tool for watershed planning and management tasks. For the GIS mapping drainage network, topography, flow path of water are to be easily find.

1.1 Watershed Management Approaches

1.1.1 Integrated Approach

This approach suggest the integration of technologies within the natural boundaries of a drainage area for optimum development of land, water, and plant resources to meet the basic needs of people and animals in a sustainable manner. This approach aims to improve the standard of living of common people by increasing his earning capacity by covering all facilities required for optimum production In order to achieve its objective, integrated watershed management suggests to adopt land and water conservation practices, water harvesting in ponds and recharging of groundwater for increasing water resources potential and stress on crop diversi1cation, use of improved variety of seeds, integrated nutrient management and integrated pest management practices, etc.

1.1.2 Consortium Approach

Consortium approach emphasizes on collective action and community participation including of primary stakeholders, government and non-government organizations, and other institutions. Watershed management requires multidisciplinary skills and competencies. Easy access and timely advice to farmers are important drivers for the observed impressive impacts in the watershed. These lead to enhance awareness of the farmers and their ability to consult with the right people when problems arise. It requires

multidisciplinary pro1ciency in 1eld of engineering, agronomy, forestry, horticulture, animal husbandry, entomology, social science, economics and marketing. It is not always possible to get all the required support and skills-set in one organization. Thus, consortium approach brings together the expertise of different areas to expand the effective of the various watershed initiatives and interventions

1.2 Problem Statement

The study area, named Bindusara River, is located in the Beed Maharashtra which will know later as Bindusara river catchment area.

1.3 Objectives

- Water availability analysis of the selected area using the GIS software.
- Management of available water in the selected draught prone area.
- To moderate the floods peaks at downstream areas.

1.4 Scopes of Work

Watershed management research is an interdisciplinary effort at multiple scales within a long-term movement towards informed participatory decision-making at the watershed level. Despite its complexities and challenges, it can provide a very effective framework for DEM. To achieve functionality it requires the best of many different areas of research and the effective involvement of diverse stakeholders.

II. MATERIALS & METHODOLOGY

We import DEM point in GIS software from data

Figure 2.1 DEM Imported

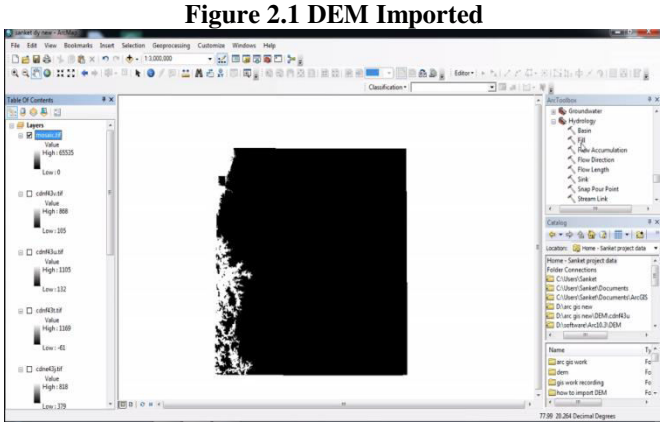

Figure 2.2mosaic

A mosaic is a combination or merge of two or more images. In Arc-GIS, we create a single raster dataset from multiple raster datasets by mosaicking them together. Alternatively we create a mosaic dataset and create a virtual mosaic from a collection of raster datasets.

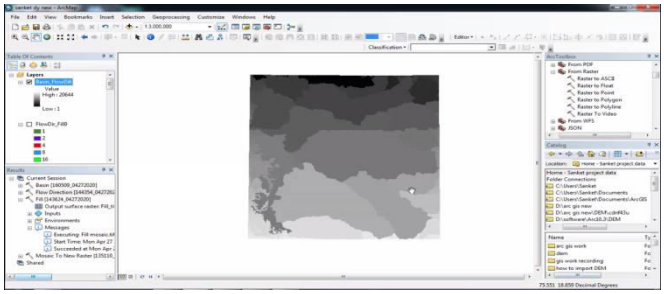

Figure 2.3 Basin Operation

The drainage basins are delineated within the analysis window by identifying ridge lines between basins. The input flow direction raster is analysed to find all sets of connected cells that belong to the same drainage basin. The drainage basins are created by locating the pour points at the edges of the analysis window (where water would pour out of the raster), as well as sinks, then identifying the contributing area above each pour point. This results in a raster of drainage basins.

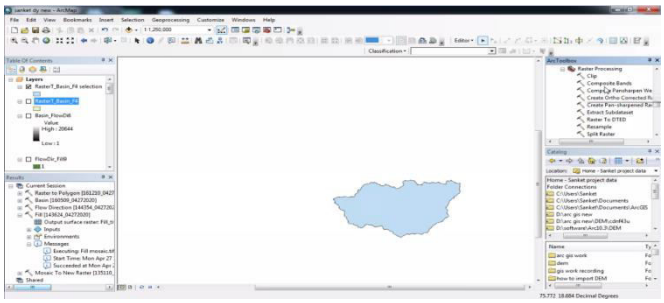

Figure 2.4 Basin

III• RESULTS AND OBSERVATIONS

A watershed is the upslope area that contributes flow generally water to a common outlet as concentrated drainage. It can be part of a larger watershed and can also contain smaller watersheds, called sub basins. The boundaries between watersheds are termed drainage divides.

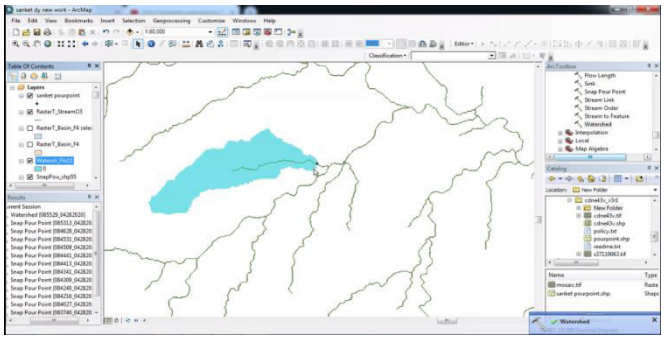

Figure 3.5Watershed raster for selected Pour point (New shape file)

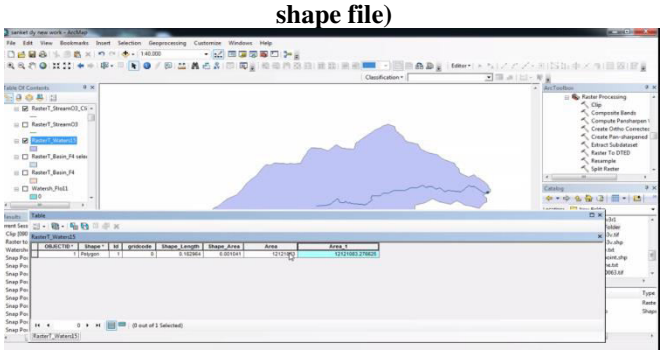

Figure 3.6 Area calculation of the watershed (in Sq.m)

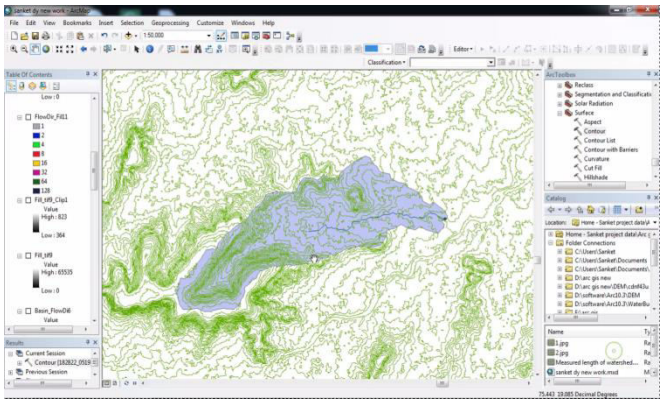

Figure 3.7 Contour Map

3.1 Calculation of total Discharge

Q (Discharge):

A (Area of catchment): 12121083 Sq.m

I (Rainfall intensity of the Catchment area): 2.54 cm/hr (Assumed)

(Neglecting infiltration and evapotranspiration losses as after the saturation infiltration loss is very small and constant and Evapotranspiration loss is negligible)

C (Constant): 0.48 (Assumed)

Q = C * I * A

= 0.48 * (2.54/100) m/hr * 12121083 Sq.m

= 147780.243936 Cu.m/hr

3.2 Morphological parameters

Table 3.1 : Morphological Parameters chart (Part 1)

Sr. No	Morphometric Parameters	Symbol/Formulae	Remark/Result
1	Area	A	12.121083 Sq.km
2	Perimeter	P	19.5697 km
3	Basin Length	L_b	7.628281 km
4	Width	W	2.023274 km
5	Drainage density	$D_d = L_b / A$	0.62934 /km
6	Basin Relief	H = Vertical Distance Between Lowest and Highest Point per unit Basin Length	km
7	Area-Perimeter Ratio	Rsp = A/P	0.61938 km
8	Elongation Ratio	$Re= 2(\sqrt{(A/\prod)})/Lb$	0.5149904
9	Circulatory Ratio	$Rc= 4\prod A/P^2$	0.397725057
10	Form Factor	$Rf= A/L^2$	0.20829942
11	Relief Factor	Rr= H/L	1.37231
12	Relative Ratio	Rrp= H/P x 100	53.49297
13	Watershed Shape	L/W	3.770266
14	Raggedness Number	Rn= H x Dd	6.588191
15	Slope Index	$SI = Lb^2/A$	4.800781

IV CONCLUSION

We studied various aspects of water management methods such as water storage, Water Infiltration etc. to use the water efficiently and manage the total quantity of water that we receive in monsoon. Total Discharge in Manson 147780.243936 Cu.m/hr.

Forestation, Silt removal from lakes and wells, Vanrai bandhara, Check dam, Farm Pond, Roof Top Rainwater Harvesting are the different rain water management measures suggested for the efficient use of water in the Beed district. The River water that we receive in monsoon gets flown away very easily. To stop that dams are useful and by infiltration methods and rainwater harvesting methods we can store the water underground and use it later. Storing the water below the ground is more beneficial than storing it on the ground as the stored water has evaporation problem and area which gets it's direct benefit is also small, whereas if we improve groundwater table, it will be beneficial for all the people as the water will itself reach near to your house, farm no need for costly pipeline connections and pumping systems.

4.1 Recommendation

4.1.1 Roof top rainwater harvesting

The site includes four types of home i.e. Mangalore tile home, Slab type home, Flat roof soil type home, Shed type home, Hence it is proposed to have roof top rainwater Harvesting from the roofs of all the buildings. Water available in one Discharge = 147780.243936 Cu.m/hr

4.1.2 Farm Pond

Farm pond. To fulfil the DEMand of irrigation potential in agriculture as supplementary irrigation water management plays an important role, because rainfall in drought prone areas is highly erratic, storage must be an integral part of rainwater harvesting.

4.1.3 Check dam

Check dams are proposed across bigger in areas having gentler slopes. Layout and construction of permanent check dams to ensure proper storage and adequate outflow of surplus water to avoid scours on the downstream side for long stability of the dam. The site selected for chew have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time.

4.1.4 Vanrai bandhara

Vanarai bandhara or Bunds are constructed across a stream or small River using gunny bags refilled with locally available soil or sand. These bags are sealed properly and are arranged in the form of a wall barrier. This is a temporary structure built across water course to collect the water as well as to reduce the velocity of stream so that infiltration rate of water increases. It helps in replenishing the aquifer below the River bed resulting in increase in ground water level in the surrounding area. Normally Vanarai Bandhara is constructed at the end of monsoon period and it lasts till the onset of the next monsoon.

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