

IDENTIFICATION OF EXISTING AND NEW WATERSHED MANAGEMENT STRUCTURES OF SAVLAJ VILLAGE USING QGIS SOFTWARE

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ABSTRACT

Maharashtra government has launched the project "*Jalyukt Shivar Abhiyaan*" in a bid to make Maharashtra a drought-free state by 2019. The project aims to make 5000 villages free of water scarcity every year. For that purpose many NGO's like NAMA and PAANI foundation are working for watershed management program at villages. The success of such programs depends on proper planning of watershed management structures. QGIS software is helpful in marking existing structures and can suggest the best suitable sites for rainwater harvesting structure. This paper includes the detail methodology to prepare plan for watershed development of a village. For that purpose Savlaj village is selected from drought prone area of Sangli district, Maharashtra. The village also participated in water cup competition of PAANI foundation. For that village, the village boundary map is prepared. Existing structures are identified by using GPS Garmin eTrex 10. Using QGIS software land use land cover, slopes and soil maps are prepared. With reference to these maps, suitable sites for various rainwater harvesting structures like contour trench, gully plug, gabion structure, check dams, K.T. weir etc are suggested. This methodology results in saving in time and money along with fair accuracy. The plans of existing and new structure are found beneficially during actual implementation of project.

Key words- Check dam, Contour trench, GPS, Gully plugs, gabion, K.T. weir, QGIS

1. INTRODUCTION

Due to rapid growth in industrialization and population, demand of water is increased drastically. Due to increase in demand of water, human extract more water from ground water table due to that depth of ground water table is reducing. For recharging ground water table we need to plan the watershed management. To plan watershed management project more time and cost is required in detailed survey. To reduce the time and cost in planning stage, the software QGIS along with Google Earth-Pro can be used beneficially. Watershed is a unit of area covers all the land which contributes runoff to a common point. (Outlet of watershed)

QGIS is helpful for extracting contours, defining slopes, generating land use/land cover map. It is also helpful for generating map of existing rain water harvesting structures and to plan new rain water harvesting structures. Planned new structures will increase ground water level and it also increases infiltration rate of land, reducing soil erosion.

II. MATERIAL AND METHODOLOGY

Study Area: The village Savlaj is in a draught-prone area of Sangli district. It is situated 40.4 km towards east of Sangli. This selected area lies in western Maharashtra state boundary by latitude $17^{\circ} 22' 22.0764''$ N and longitude $75^{\circ} 8' 54.5964''$ E having an elevation of 689 m. It covers a total area of 31.78 sq. km. As per the census of 2001, the village has a population of 10140. The climatic condition of Savlaj is 29°C [10] and average annual rainfall is about 147.852 mm (IMD 2016).

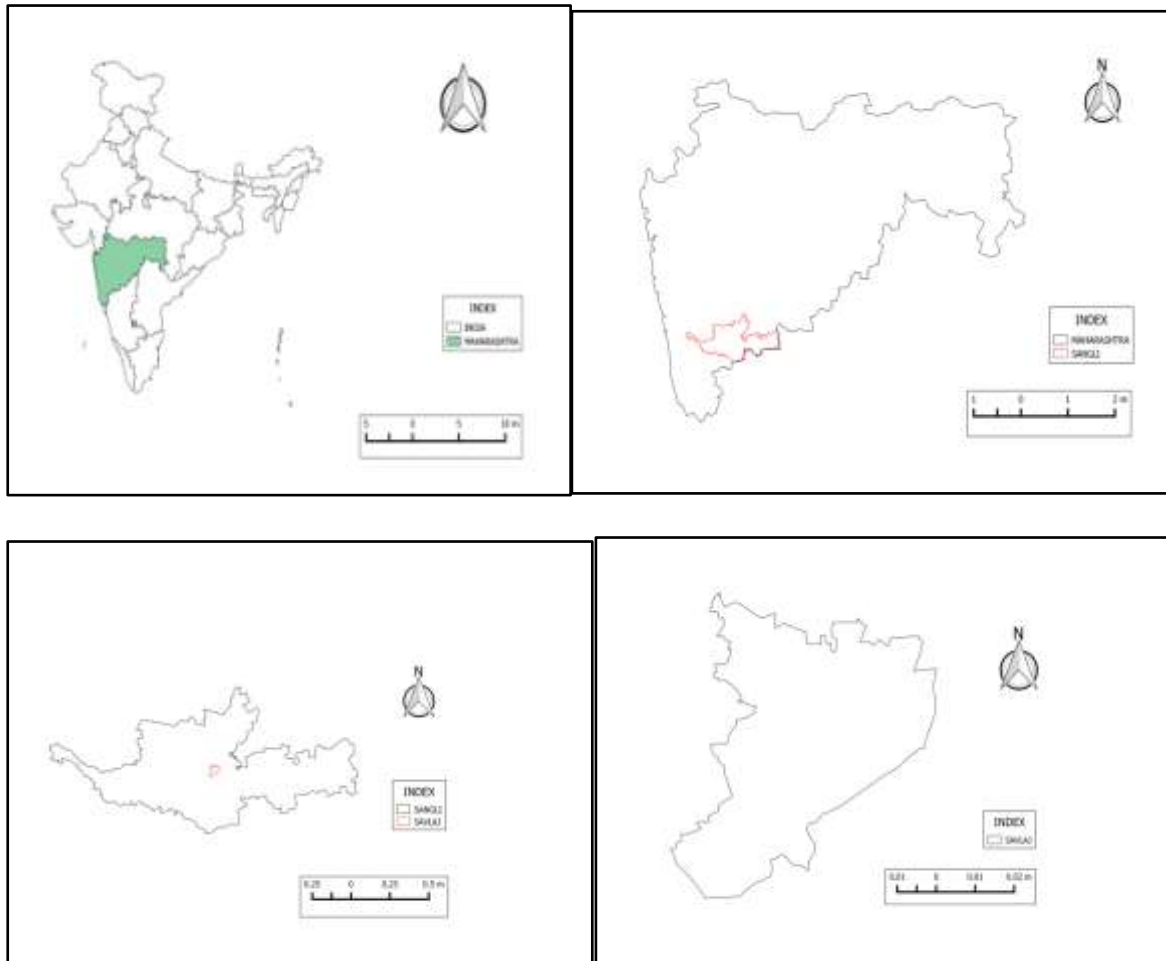


Fig.1 Location map

Reconnaissance survey– In this the latitude and departure of existing structure should be obtained by using GPS on site like Garmin eTrex 10. By using this latitude and departure we can easily mark out existing structures. Following map shows existing structures.



Fig.2 Existing structures.

Generating Contours using QGIS- As we know development of contouring is very lengthy process with the help of instruments like auto level or even if Total Station. Using QGIS software we can able to develop contours within short time.

Following map shows the contours of study area having contour interval of 5 meters.

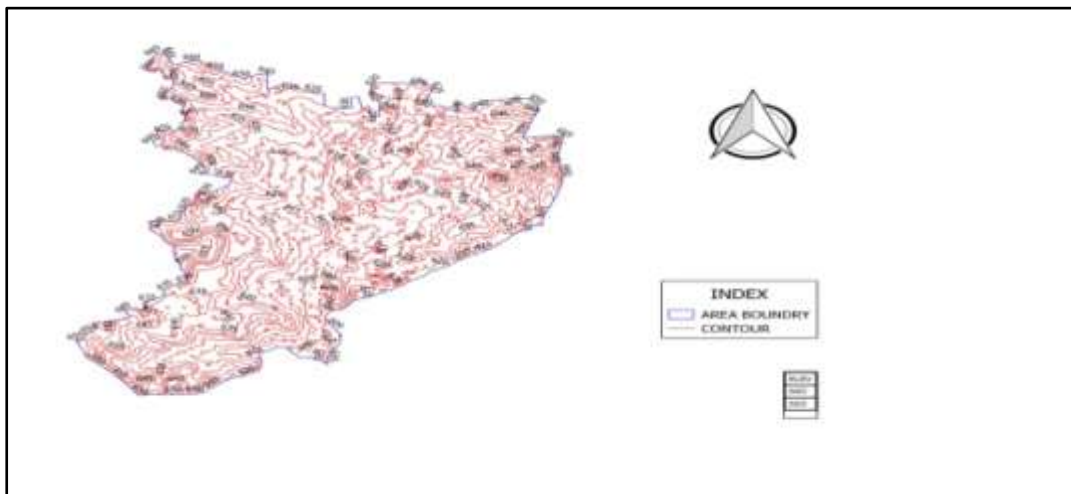


Fig. 3 Contour map

Preparation of slope map – In QGIS slope map of any area can be prepared. Following map shows maximum and minimum slope of study area. It is very helpful for planning rainwater harvesting structures like contour trenches, gully plug, gabion structure, check dams, K.T. weir etc. are suggested.

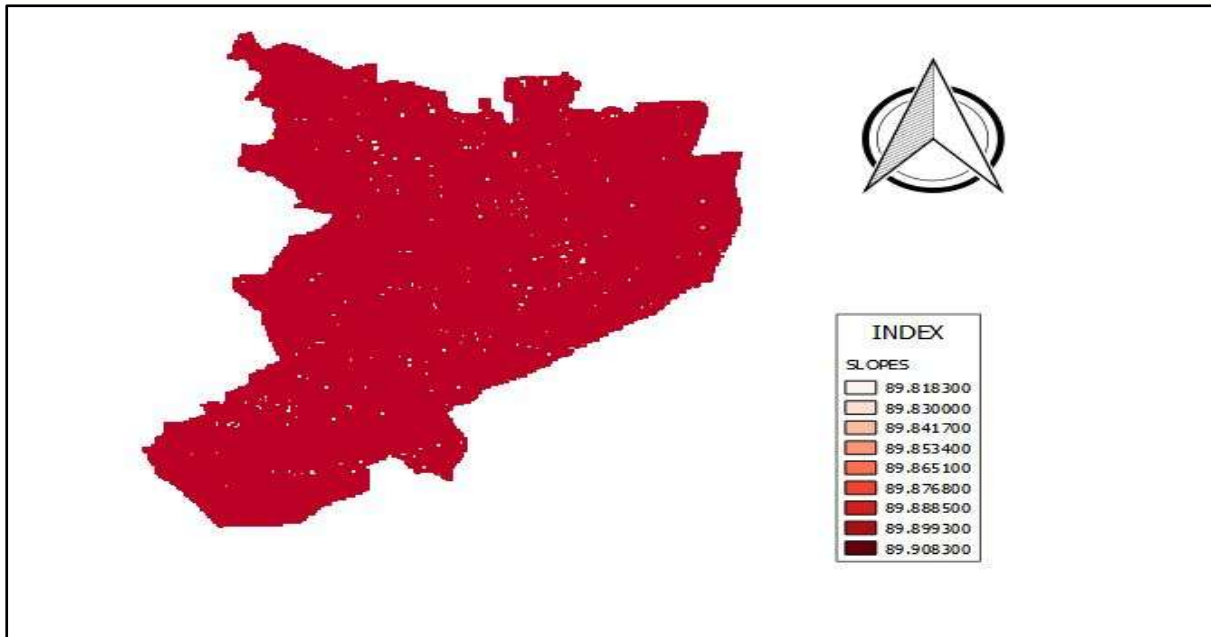


Fig.4 Slope map

Profile of Agrani River—With the help of River profile it is possible to plan the numbers of Nala bunds or K.T.Weir in series.TBL for first structure will be the toe of second structure.Also it is possible to fix the crest height and storage capacity can be computed.



Fig.5 Profile image

Planning of new structures - based on above information and depending on slopes, soil strata, elevation we can plan various structures suitable for that site.

A) Gully plug: constructed at first and second order small streams. It should be made where bed slope of drainage line is less than 20%. The use of angular stone gives greater stability and also use smaller stone to fill up the interior gap and construct the structure should be trapezoidal shape.

B) Gabion Structure: Gabion structures are planned on the steep bed slope of the drainage line. For greater stability of structure use of angular stone is advisable. Rock fill embankment is provided protection with help of wire mesh on all side. Wire mesh is firmly anchored in ground with anchor piles.

c) Contour trenches: Deep CCT trenches are planned at top of the hill and CCTs are planned along hill slopes with uniform slope. (Between 10% to 25%)

d) Check Dam and KT weir: it is constructed along main streams, Nalasar river and has Slope (less than 10%)

e) Percolation Tank: It should be located on highly fractured rock for speedy recharge. It is earthen embankment constructed as earth dam. Its function is only to recharge ground water. This is tapped by farmers from downstream side by open well and tube wells. Already there are sufficient percolation tanks in village.

III. CONCLUSION

1. Remote sensing, GPS and software are very useful to plan rainwater harvesting structures like contour trench, gully plug, gabion structure, check dams, K.T. weir etc are quickly planned with the help of QGIS.
2. QGIS is found very easy to use and provides more satisfactory result in short time as compare to conventional planning. The planning cost reduction is also significant.
3. Gully plug are planned on first and second order small streams with gentle slope. Deep CCTs are planned at ridge point of hill. Gabions are planned along drainage line with steep slope. CCT are planned along hill slopes with uniform slopes. Series of Nala bund is planned along Agrani River.
4. Suitable site checks are necessary before actual implementation of project.

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