"Watershed Management - A Case Study Of Madgyal Village"

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Abstract

Madgyal is a small village located at distance of 25 Kms from Jath city. It lies between North latitude 17°02'56.94" and East longitude 75° 13'8.14". Some measures have been adopted to recharge the ground water resources. Hence it is planned to take such engineering and biological measures which will direct this extra runoff to ground water storage. The most significant feature of the work is that if such technologies are developed and adopted at larger scale in rural areas, it will prevent thousands of villages of the country from water supply by tankers. 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. In the Madgyal some measures have been adopted to recharge the ground water resources, but it has been found that these measures don't work with full capacity in some cases. In the Madgyal watershed area, demand of water for agriculture and drinking purpose is increasing rapidly depleting water resources coupled with overpopulation. Efforts are made to divert large amount of rainwater to recharge ground water resources.

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

1. Introduction

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 100-200m below the ground surface.

2. Drought of 2013: The story of Maharashtra's water woes

Present drought situation in Maharashtra is hydrological worse than in 1972. Construction of large dams, water intensive cropping patterns, neglect of local water systems and unaccountable water management are to blame for this unprecedented situation. A former planning commissioner agrees that large dams are not the solution to Maharashtra's water worries. In spite of acute water scarcity, Water business booms in drought-hit Marathwada as tanker owners transact Rs.6 million in water sales daily in Jalna town, Maharashtra. The state must look at renewable energy options to reduce its dependence on thermal plants and diversion of its precious water to them. In comparison with the 1972 drought, though there is ample supply of food grains at present, the drinking water scarcity is much worse.

3. Methodology

The methodology adopted for the present area includes the collection of data
1) By observation and discussion with local people
2) By personal interviews of the local people.
3) Through Questionnaires prepared and getting filled them by people.
4) Through Social Mapping of the areas for developing the social relationship with the local people.
5) By GIS Survey including contour map, natural stream line map, water delineation map giving land use details.

4. General and socio-economic survey

1) Madgyal is a village in Jath Taluka, district Sangli, state Maharashtra, country India
2) Coordinates are Latitude 17°02'56.94" N, Longitude 75° 13'8.14" E
3) It is 21.8 km away from taluka main town Jath
4) Area of Madgyal village is 2256 hectares.
5) Total population of Madgyal village is 5555; male: 2571, female: 2264.
6) Average annual rainfall: 382.18mm (2002-2012)
7) Literacy rate of Madgyal is 60.82%
8) Sex ratio is 881 females per 1000 males.
9) Major occupation is sheep rearing and minor occupation is agriculture and other agro based side business.
10) This minimum requirement of water is hard to be satisfied all year long.
11) Water scarcity arises in the month of January and lasts up to May.
12) These five months tend to be critical water shortage period.

4.1Sources of Livelihood

Like many villages in India, Madgyal is also characterized by the greater dependence of inhabitants on agriculture, sheep raring, agricultural labor, MIDC labor for their livelihood. The graphical representation of various sources of livelihood in Madgyal is given below. The total income of most of the households below Rs.10000 per annum is 1.74%, Rs 11000-Rs 20000 is 12.33% , Rs 21000-30000 is 31.08%, Rs31000-50000 is43.42%,above Rs 51000 is 11.40%.only few families having higher income in the range above Rs.50000 per annum. It is evident that almost 89 percent of the households have annual income in the range of Rs. 5000 to Rs. 50000. As per living standard & per capita water requirement it is decide that this area is drought area. For the socio-economic survey per capita water requirement is 35-40 lit /day.

4.2Land Holding Pattern

Land is below 5 Acer is 58.67% & above 5Acer 17.79% &23.42% people no land available. We have concluded that 76.46% people land is available but perennial sources of water are not available. If the perennial sources of water are available then this people living standard & economic condition are to be increased.

Table-land distribution

Land in **Acres**	Percentage of household
0-5	58.67%
6-10	15.01%
11-20	2.32%
Above 20	0.46%
No land	23.42%

4.3. Drinking Water

The water sources in the village are not perennial. The village women and children travel half kilometre a day during June to January for fetching water from nearby wells and tube well. The situation is worse in winter and summer seasons (during January to May). On an average they cover 4 Kms to and fro to fetch water for daily domestic requirements. Men do not participate in rainy season for fetching water; however, a thin participation is there during the months of January and May. It indicates that this area is drought area and requirement for watershed management technique.

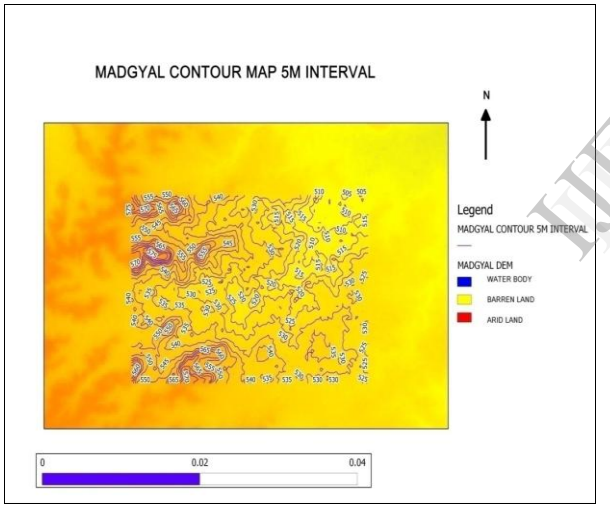
4.4 Residential status (housing condition)

As per socio-economic survey, there are varies types of homes. Slab (3.14%), Mangalore tile (26.63%), flat roof soil type (28.63), shed (32.82%) are available. For the type home, watershed management technique like top rainwater harvesting technique is to be suggested.

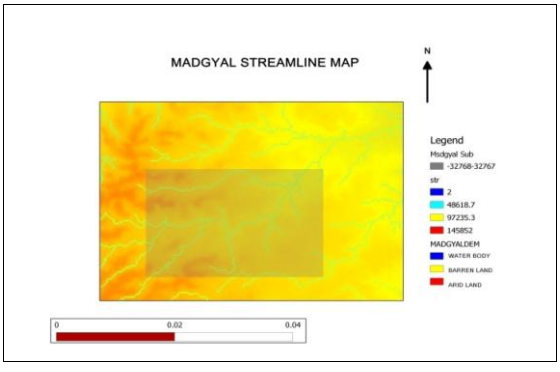
The precipitation intensity and characteristic vary drastically in Sangli district. In the parts of Krishna river basin and vicinity the rainfall statistics

are comparatively good and enough to recharge major catchment. On the contrary, the eastern region is more droughts prone and is consistently under water scarce condition. Perennial River flowing in the vicinity of Madgyal is Krishna which is at the distance of 100km. Lakes present in Madgyal is Vespeth Lake, Guddapur Lake. Lakes are not perennial hence posing a problem.

The existing water supply scheme is driven by lake water and is not perennial. There is no such existing rain water harvesting scheme present in the village. The water available due to rains is not conserved. The dual effect of less rain and no conservation has led to scarce conditions in the village. Hence there is an extreme need of feasible and sustainable methods of watershed to this village. Through watershed the available rain water can be usefully led to recharge resources or directly store and use it during the water scarcity.



Contours are lines that connect points of equal value (such as elevation,). The distribution of the lines shows how values change across a surface. Where there is little change in a value, the lines are spaced farther apart. Where the values rise or fall rapidly, the lines are closer together. The areas where the contours are closer together indicate the steeper locations. They correspond with the areas of higher elevation.



This map displays the streamlines existing in the study area

It shows natural flow lines of the terrain and helps in analysis of Watershed in the area.

5 PROBLEMS EXISTING IN THE AREA:

1) Poverty
2) Low income levels hence low living standards
3) Lack of water supplies in summer season
4) Agricultural production in only one season
5) The average rainfall is very less i.e. average annual rainfall of 382mm.
6) The rainfall fluctuation is very high i.e. .in the year 2002 is 162 mm and in the year 2004 is 704 mm.
6) Silting of existing water resources like Lake, Wells.
8) Insufficient rainwater harvesting structure .scarce rainfall and less awareness has caused the drought conditions at the village -MADGYAL.

6. GEOLOGY OF THE AREA:

Topmost layer of the land is covered with black cotton soil in flat areas. Soft murum is exists in steep-slop areas. Depth of soil cover ranges from 0 to 3m. Below this soil amygdule basalt, vesicular basalt & fractured basalt is there.

7. WATER AVAILABILITY IN THE AREA:

Catchment area: 2256 Ha.
Available water due to rainfall: 1025176.4Cu.m

8. PROPOSED WORKS IN THE AREA:

1) **Roof top rainwater harvesting** The site includes four type 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. Total water available in one monsoon= 18101 cu.m.

2) **Farm pond.** To fulfill the demand of irrigation potential in agriculture as supplementary irrigation water management play an important role, because rainfall in drought prone areas is highly erratic, storage must be an integral part of rainwater harvesting. It is therefore necessary to harvest water from any water sources e.g. precipitation, perennial sources, roof water etc. in ponds and reservoirs for varies domestic, agriculture and industrial purpose over a period of time to stretch its usage to the maximum.

In addition to the above following factors are considered while constructing farm pond

a) Area selected for farm have gentle ground slope.

b) Water released into the pond is sediment – free

c) Rate of inflow into the pond is slightly more than the infiltration capacity of the entire pond.

d) Effective size of the square pond is 15m x 15m x 3m. It is decided on available Space & topographic conditions of land

Design details.

1) Excavation detail:

Top dimensions of pond = 15m x 15m, Bottom dimensions of pond = 9m x 9m,

Depth of pond = 3m,

Side slope to excavation = 1:1

2) Side earthen bund details: Top width = 0.9m, Height = 1.0m, Side slope = 2:1

3) **Check dam.**

Check dams are proposed across bigger streams and 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-term stability of the dam. The site selected for check dam have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time.

Design details.

Available land slope = 0-15(%)**,**

Horizontal interval (Spacing between two bunds) = depends on site conditions

Dimensions of the Check dam:

Top Width = 1.0 m

Base width = 2.0m

Height =3.0m above ground

Depth of foundation = 1.0m

Length of check dam = depends on site conditions

Freeboard = 0.50m

3) **Vanarai 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.

Vanrai bandhara are constructed just after the last rains to arrest the runoff and store water .For few months into the dry season. The typical height of a vanrai bandhara is about 0.8 m to 1.2 m. Length of the bandhara ranges from 6-7 m up to 25 m. The breadth of the bandhara is about 2 m to 2.5 m. The bags used for the vanrai bandhara are 40cm x 30cm x 15cm (l x b x h).

9. Conclusion

In the Madgyal village there are mainly four types of home, for this home we have proposed roof top rainwater harvesting system. For this top rainwater

harvesting system for one monsoon water to be conserved 18101 cu.m.. One family can use this collected water for four month. Vanrai bandhara is a low cost bandhara. Using gunny bags refilled with locally available soil or sand. Cost of bandhara for 6m length and 1.2 m height only Rs 15000/. With the help of Check dam, Vanrai bandhara water is stored and can be used to easily recharge the ground water. The main function of Farm pond is store the water. During the rainy season this water will be stored and use for summer (scared) season. For successful implementation of this project participation of local people, government officers, and funding agencies is must. As these techniques are eco-friendly, the development due to this in future will be sustainable.

10. REFERENCES

1) Pat O'neill, Ben Higgins, And Christine Rohrer "Applying Integrated Watershed Management Techniques In Stevens Creek", Water Environment Foundation 2006

2)Dr.Mrs.Sushma Shekhar Kulkarni And Mrs. Vidula Arun Swami "Watershed Management – A Means Of Sustainable Development" - A Case Study International Journal Of Engineering Science And Technology Vol. 3 March 2011 Pp.2105-2112

3)Krishna R. Tiwari Roshan M. Bajracharya And Bishal K. Sitaula "Natural Resource And Watershed Management In South Asia: A Comparative Evaluation With Special References To Nepal" The Journal Of Agriculture And Environment Vol:.9, Jun.2008 , Pp.72-89

4)P.K.Joshi ,V. Pangare ,B. Shiferaw S.P.Wani ,J.Bouma And C.Scott, "Watershed Develop In India : Synthesis Of Past Experience And Need For Future Research" Vol.59,Ind. Jn.Of Agri. Econ. Vol.59 July-Sept.2004

5)Budumuru Yoganand1 And Tesfa G. Gebremedhin "Participatory Watershed Management For Sustainable Rural Livelihoods In India", 2006

6)U. Sunday Tim Sumant Mallavaram "Application Of Gis Technology In Watershed-Based Management And Decision Making" Watershed Update Vol. 1, Pp.1-6.

7) Bharat R. Sharma and Christopher A. Scott "Watershed Management Challenges: Introduction and Overview'' International Water Management Institute, South Asia Regional Office, New Delhi/Patancheru, India, 2005 Pp.1-21

8)Suhas P. Wani and Y.S. Ramakrishna ''Sustainable Management of Rainwater through Integrated Watershed Approach for Improved Rural Livelihoods'' International Water Management Institute, South Asia Regional Office, New Delhi/Patancheru, India, 2005 Pp.39-6o

9)V.N. Sharda ''Integrated Watershed Management: Managing Valleys and Hills in the Himalayas'' International Water Management Institute, South Asia Regional Office, New Delhi/Patancheru, India, 2005 Pp.61-81

10)J.S. Samra Policy and Institutional Processes of Participatory Watershed Management in India: Past Lessons Learnt and Future Strategies '' International Water Management Institute, South Asia Regional Office, New Delhi/Patancheru, India, 2005 Pp.119-128