FARM POND - THE BEST SOLUTION FOR WATER CONSERVATION IN RURAL AREA

Dr. Mrs. Vidula A. Swami
Professor, Civil Engineering Department, Kolhapur Institute of Technology, (Autonomous Institute), Kolhapur, India, Email id:
Dr. Mrs. Sushma S. Kulkarni,
Director, Rajarambapu Institute of Technology, Sakharale, Sangli, India,
Mr. Sheetal S. Varur
Assistant Professor, Civil Engineering Department, Kolhapur Institute of Technology, (Autonomous Institute), Kolhapur, India,
Mr. C. V. Nishikanth
Director & GIS Consultant, Hagrois, Chennai, India,

ABSTRACT -India is the country of villages with large population living in the rural areas. In the hilly areas due to high velocity of water, soil conservation is a tedious job. If rainwater harvesting is done in these areas, soil will get conserved as well as the ground water storage will be increased. The study is undertaken to develop an appropriate technology for soil conservation and to verify the increase in the ground water storage in such area. This gives dual benefit of soil conservation as well as ground water recharge for the area thus saving the area from severe soil loss as well as increasing the water availability below the ground surface, thus fulfilling the water demand of the village and protecting the top fertile soil from getting washed away due to rainfall.

Considering the topographical features of a small plot of area 2 hectares of Kaneri watershed situated in Kolhapur District, Maharashtra, the structures for water conservation had been implemented in it in June 2011. The structures included gulley plugs on existing water stream followed by the farm pond at its end along with farm terraces and continuous contour trenches surrounding the water stream. These practical evidences proved the positive impact of watershed development structures on water conservation and ground water recharge. Similar measures were taken in KIT campus in Gokul Shirgaon as per its topographical and hydrological situations and the results were evaluated.

KEYWORDS: Farm Pond, Water Conservation, Continuous Contour Trenches, Ground Water Recharge

INTRODUCTION

Substantial variations in the quantity, incidence and duration of rainfall in individual tracts of India from year to year make watershed management of supreme necessity in the country, which when implemented, adds one drop in substantial water supply and at the same time subtracts the same drop from the potential flood, thus giving twofold benefit to the community [1] . Watershed management tries to bring about the best possible balance in between the water resources on one side and human and other living beings on the other, improving socio economic status of the villagers [2]. Some original work of watershed management in India have been successful .The most notable of these is the inspiring work of Mr. Annasaheb Hazare in Ralegan Siddhi village.[3] The rainwater harvesting technique is used to store the rainwater from the rooftops, from the catchments, to increase the ground water storage as well as to conserve the soil which flows along with the rainwater if the measures are not taken. [4]. Considering the severe water scarcity the country is facing today, it will be beneficial if the steps are taken to enhance the ground water recharge of the area. State Government is also taking the steps to fight against the drought. The government set up a task force headed by Anna Hazare and promised to allocate 300 crores to the programme. The programme's early and biggest success is Hiware Bazaar, a village located in the rain-shed area of Ahmednagar district in India, the same district as Ralegan. [5].

Farm ponds have a significant role in rain fed regions where annual rainfall is more than or equal to 500 mm. If average annual rainfall (AAR) varies between 500 to 750 mm, the farm ponds with capacity of 250 to 500 m^3 can be constructed. If AAR is more than 750 mm the farm ponds with capacity more than 500m^3 can be constructed particularly in black soil regions without lining. It was observed from field experience that at least two to three rainfall events can occur, making the ponds highly beneficial to farmers. [6]. 853 Hectares area of Shivaji University Campus, Kolhapur district, Maharashtra, India has been surveyed and depending on its geology, topography and soil, a pond of capacity 8.52 million cubic feet, along with continuous contour trenches, check dam and nallah bunding on about 51 hectares area have been constructed. For last three years, the University has become self sustained in water requirements for the whole campus. Three more water tanks have been proposed in the campus for recharging ground water. [7].

The study area – Kaneri watershed, 11 kms south east of Kolhapur is situated in hilly terrain with an average annual soil loss 11.172 Tonnes/Ha/Year. Two small plots were selected for pilot study, surveyed and the watershed management structures suitable for the plots like farm pond, gulley plugs, continuous contour trenches and farm terraces were implemented in 2011 [8]. Results from one plot of 2 Ha. area showed that, due to these measures, the per capita income of the plot owner increased by 38.33 % for the first year immediately after implementation as crop yield increased from 15 Quintal to 20.75Quintal. Predicted annual water storage was 3060 cum due to which the farmer could take crops like Jowar, Corn, rice and groundnut in his field where he could not take even a single crop due to undulating terrain [9].

Suhas P. Wani [10] studied the areas with annual rainfall 7500 mm and proposed runoff harvesting and groundwater recharging structures as earthen check dam, masonry check dam, farm ponds, loose boulders, gulley check and percolation ponds. It is estimated that due to these engineering measures, sustainability of the production system in the region may enhance and soil loss in the micro watershed may be restricted to 2 tonnes / ha / year [11].Dr. Ramalingam M. [12] analyzed the terrain of Kuluvikulam block in Tirunelveli district covering the villages of Vellakulam, sevalkulam, Pulliankulam and Ayyaneri. For highly and moderately favorable zones, percolation ponds and check dams were proposed. For less favourable zone, recharge pits or recharge trenches were proposed whereas for poor zones no any structure was suitable. Percolation pond is a shallow depression created at lower portion in a natural or diverted stream course and is adaptable where 20-30 ground water wells exist within the zone of influence about 800-900m. Jothiprakash V.[13] assessed that the percolation pond has increased the water availability by about three times as compared to the situation without pond.

METHODS

a) Pilot Plot in Kaneri

Collection of primary data in pilot plot study was done by observation and discussion with local people, through questionnaires, through social mapping and by Technical surveys. Collection of secondary data had been achieved through census records, preparation of maps by satellite data and website data. For evaluating the impact of watershed management techniques on economic status of the people, pilot plots were selected where best possible management practices have been implemented. Figure 1 shows the map with the watershed structures implemented in the watershed in two different plots. Plot no 1 was used for analysis for prediction of water storage due to construction of suitable rainwater harvesting structures. The plot no. 2 was not used for analysis due to non availability of the data after construction of the structures there.

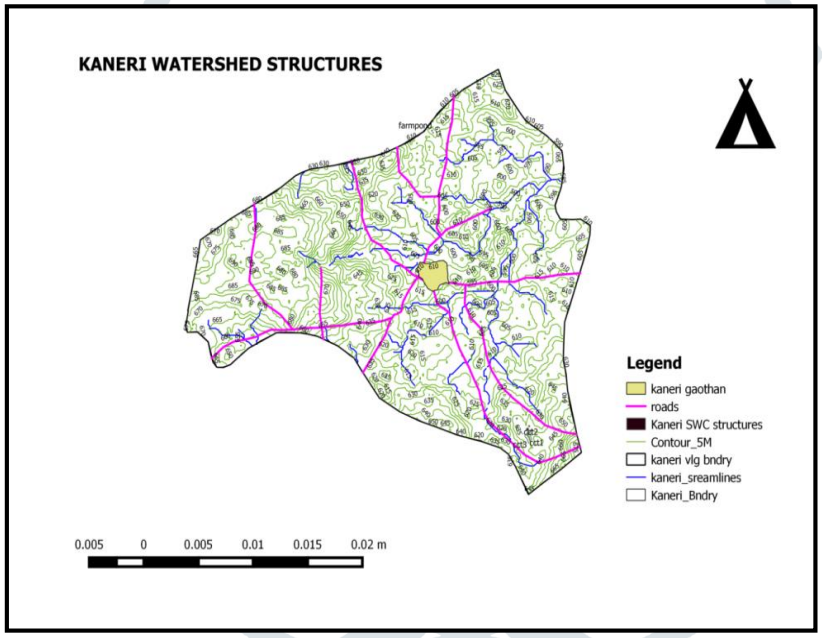

Figure 1 - Watershed management plan for pilot plots

The structures were constructed in the pilot plot according to the site conditions there. The area is hilly with flat terrain at the foot hill. By discussion with the plot owner and studying the topography of the area, the recharge structures appropriate for the area were finalized. These were the farm pond of size 15m.*15m. at the top with 9m.*9m. at bottom with 3m. height, gulley plugs 2 in number at 12m. interval on the existing nallah on the upstream side of the farm pond, three continuous contour trenches (CCT) of 15 m. length at 10 m. interval on the sloping ground. The construction was done with the local labour under supervision of the plot owner. The farm pond was excavated with the help of JCB owned by the local person, resulting in reducing the total cost of the overall construction. The details of the cost of the construction of the structures have been given in table 1. The water recharged in pilot watershed plot of 2 Ha area due to constructed structures was estimated to be minimum 3060 cum. per year.

Table 1-Total Cost of the structures constructed in pilot plot no.1

Recharge Structures	Water Recharged	Cost of Construction
Farm Pond (15mX15mX3m)	1836 Cum.	Rs. 35,000/- only
Contour Trenching	1224 Cum.	
Gully Plug and Earthen Bunds		
Total Recharge of Water	3060 Cum.	

b)Experimentation in Kit Campus

As per KIT campus is concerned, it is hilly terrain with a huge scope of water conservation through harvesting the rainwater by making each raindrop to penetrate at the point where it strikes the ground. As per the topography of our Institute is

concerned, this is the best site for watershed development. For all water conservation structures, only available stones and soil can be used, thus making the material cost nearly zero. The plantation can sustain well on the contour trenches . This will certainly improve the landscape beauty of the campus. Taking into consideration all these facts about water conservation and topography of KIT campus, the following measures have been taken :

1. Deepening the existing farm pond near Boys' Hostel.
2. Staggered contour trenches on upstream side of the lake.
3. Continuous contour trenches with plantation on all possible existing slopes in the college campus making running rainwater to stop
4. Gulley Plugging with provision of Check Dams on the water stream discharging in the lake at 10 m interval obstructing stream water.
5. Plantation as per Green Campus Plan

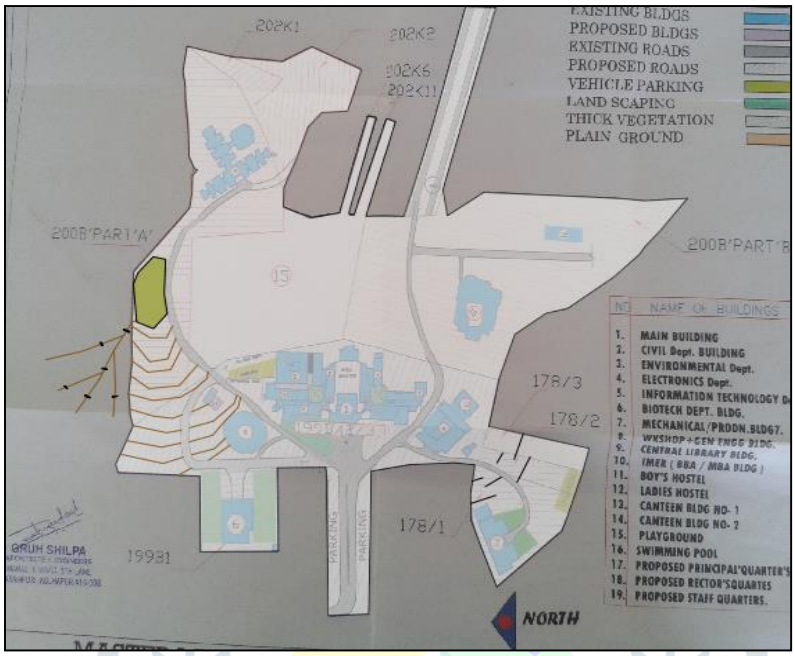

Figure 2 : Watershed Management Plan Of KIT Campus

Expenses

The watershed development structures do not need any construction material, as the material excavated can be used for construction of berms. Only expenditure will be on excavation (hiring charges of JCB) and labour charges for filling the berms. Table 2 gives expenditure details.

Table 2: Expenditure of Water Conservation Works

Sr. No.	Details of the work	Nos.	Rate	Cost
1	Deepening the existing lake near Boys' Hostel.	01	20,000/-Lump sum	20,000
2	Staggered contour trenches	06	500/-	3,000/-
3	Continuous contour trenches	15	1,000/-	15,000/-
4	Gulley Plugging with provision of Check Dams	05	3,000/-	15,000/-
5	Plantation as per Green Campus Plan		60,000/-	60,000/-
6	Other expenses	-	-	7,000/-
	Total Expenses			1,20,000/-

RESULTS AND FINDINGS

a) Kaneri Pilot Plot

During the visit to experimental plot area before intervention (May 2011), lots of soil erosion was found. The sites remained idle for so many years. Due to the continuous erosive action of water, land was changed into barren land. The water conservation structures were constructed, which resulted in growth of grass in the immediate monsoon. It also resulted in maintaining soil moisture content. The field owners could have cultivation in larger area of the sites due to availability of irrigation water and soil moisture throughout the Kharif season.

The structures were constructed before rainy season. Pilot plot was kept under observation frequently, in order to find out impact on rise in water level, soil erosion & utilization of water. After monsoon the changes as below were found in the plot.In the absence of structures no wells were full of water for so many years. It was found that there was sudden rise in water level as soon as the construction of water conservation structures. The surface runoff in the nallah was checked due to construction of gully plugs, earthen bunds, farm pond etc. Observations were taken at the end of month oct.2012. Increase in

ground water table in watershed area is one of the important measurable indicators for the success of watershed development. Figure 3 shows the water level in the farm pond immediately after construction and at the end of month of September respectively. (October 2011).

Figure 3 - Water stored in Farm pond at end of monsoon in Kaneri

b)KIT Campus

As per KIT campus is concerned, due to soil and water conservation techniques implemented on the area, it was possible to conserve a huge quantity of rainwater which is beneficial for our college for our water needs. The well (Figure 4) existing on downstream side of the structures could fill after only three spells of monsoon due to these structures. Figure 5 shows the photograph of farm pond as on 24th June 2018.. The plantation could sustain well on the contour trenches. This has also improved the landscape beauty of the campus along with water conservation.

Figure 4 and 5 – Water levels in well and farm pond after three spell of rain (24th June 2018)

CONCLUSION

a) Kaneri Pilot Plot

The pilot plot selected for experimentation had shown the expected results revealing the better need of watershed management for such areas as well as it had given better results of soil and water conservation showing the gain in farm yield as well as increase in water levels of surrounding wells. By implementation in the pilot plot, the farm pond along with appropriate structures on its upstream side for checking soil loss proved to be efficient for controlling soil erosion and a sustainable development option in the watershed. It is concluded that, economical development of villagers will be possible through watershed management. Watershed management for Kaneri village will render the people self sustaining. This will also help to solve the present problem of overcrowding of the cities.

b)KIT Campus

It is found that, for last year, the water supply to girls hostel, boys hostel, institute's daily supply was fulfilled from only well water supply upto month of February. No outside water supply was needed. This was possible only due to farm pond followed by gulley plugs. Amount of water which can be conserved on KIT campus of area 30 Acres, if developed further for roof top rainwater harvesting also will be 8.02 crores of liters of water annually and recharge existing well continuous regularly.

ACKNOWLEDGEMENT

We gratefully acknowledge the assistance of a farmer Mr. Datta Patil , the owner of the pilot plot in Kaneri. This paper is based upon the results of the work carried in his farm. The support and financial assistance provided by our institute management for the construction of farm pond and related structures in KIT campus are also gratefully acknowledged.

REFERENCES

[1] Vidula Swami, Dr. Sushma Kulkarni, (2011); "Watershed Management - A means of sustainable development-A case study ", International Journal of Engineering Science and Technology,3(3),2105-2112

[2] Anita V. Naik, , (2009) "Watershed Management: A Way to sustainable development". CAB Calling Newsletter , July – Sept.2009

[3] B. Mishra , (1996), "A successful case of participatory watershed management at Ralegan Siddhi Village in District Ahmednagar, Maharashtra, India", FAO Corporate Document Repository.

[4] Kakade B. K., (2012); "Integrated watershed Development Program: Baif Experience", Technical Report

[5] Asha Kapur Mehta, Trishna Saptathy, (2008); "Escaping poverty: The Relegan Siddhi Case", Chronic Poverty research centre, Working Paper No. 119.

[6] K. S. Reddy, Manoranjan Kumar, Rao K. V., Maruthi V., Reddy B. M. K., B.Umesh, G. Ganesh Babu,K. Srinivasa Reddy, Vijayalaxmi, B. Venkateswaralu, (2012); "Farm Ponds – A Climate resilient technology for rainfed agriculture planning, design and construction", Farm Ponds Technical Bulletin 2012.

[7] Ingavale R. R., Jadhav V. V., Raut P. D., (2013); "Studies on watershed Management in Shivaji University, Kolhapur, India", International Research Journal of Environmental Sciences, (7), 35-38.

[8] Santosh Kumbhar, (2012);"Watershed Development Plan for Kaneri Watershed", M. E. Thesis, Rajarambapu Institute of Technology, Sakharale

[9] Vishal Kumbhar, Vidula Swami, Sushma Kulkarni, (2013); "Effectiveness of watershed management-A means of economic development - A case study", Journal of Mechanical and Civil Engineering,6(6),7-14

[10] Suhas P. Wani, Johan Rockstorm, Canwar Lal Saharawat, (2011); "An Integrated Watershed Management in Rainfed Agriculture", CRC Press Publication,Taylor and Francis Group, London, U.K.

[11] Singh R. K., Lama T. D., Satapathy K. K., (2006); "Treatment Technologies for watershed development and management in north east hill region", ENVIS Bulletin on Himalayan Ecology, 14 (1),

[12] Dr. Ramalingam M., Natarajan. T., (2000); " Identification of recharge areas using Remote Sensing and GIS", National Natural Resource Management System (NNRMS) Bulletin (B) 24. Bangalore, India.

[13] Jothiprakash V., Mohan S., Elango K., (1997); "Influence of percolation ponds-A recharging structure in a small watershed", Proceedings of National Conference on Ground Water Sources at JNTU Hyderabad , 280-289