

A Case Study of Watershed Management in Sonari-Maharashtra

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Abstract— Sonari is small village in Aurngbad District of State Maharashtra. It is facing acute water security problem due to insufficient rainfall every year. Watershed development structures like rain water harvesting, check dam, vanarai bandhara ,farm pound, are suggested to make the village self sufficient in case of water demand.

Key words: Watershed Management, Rainfall, GIS Software

I. INTRODUCTION

Aurangabad district is located mostly in godavari basin, fall under maharashtra Agro-Climatic zone VII. It is assured rainfall zone with average rainfall of 450-650mm..The average land holding is less as compared to other areas. The small and marginal farmers here solely depend on monsoon rain for their livelihood. The % of irrigation is very low and there is no buffer for experiments.

The area mainly has basalt rocks with limitation to infiltration. The ground water level has gone much lower than it was a decade ago. The river are seasonal. Te green cover on the hils is administrated. The soil is low and agro technology has not fully reached to the small farmers in the region and they are always debt ridden. The entire wheel of development of this region revolves around the availability of water for irrigation.

Recently this region has become infamous for the state's worst drought. In decades facing acute storage of drinking water and fodder and farmers suicide cases. Through various schemes, the government has constructed various water conservation structures on rivers and small streams, but village wise full watershed treatment is not performed. The constructed structure are mostly defunct not serving any purpose. The main reason are lack of periodic maintenance and lack of ownership by villagers. The structure and percolation tank of water reservoir are full of silt as they war never de-silted in the past. This has affected the storage and ground water recharge capacity of the water structure to great extant.

II. PROBLEM STATEMENT

The Aurangabad District area is presently facing serve drought condition due to low rainfall and defunct water harvesting structures. During the monsoon season 2015-17 the cluster received only 710mm rainfall causing the failure of kharif crops. Nearly 85% of horticulture crops in the harvested cluster were completely dried due to non-availability of water even with the drip irrigation. This drought also hit the performance of the rabbi season and only 5-6% of rabbi season could be cultivated which also face water scarcity problem leading to very little or no production. The wells in the downstream sides of the catchment had little water which was used for drinking on priority basis.

III. OBJECTIVES

- To analyze source of water of resources available, in Sonari.
- To analyze the socio-economic condition of people,in Sonari.
- To complete the water demand and analyze the supply.
- Results and Interpretation.
- Guideline of water shed development.

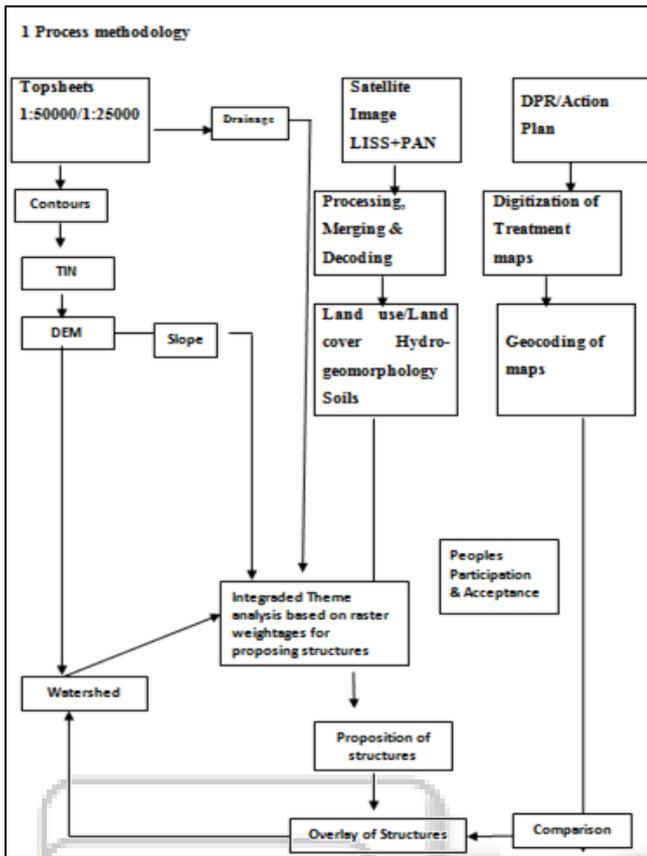
IV. METHODOLOGY

The proposed work is planned in following phases,

- 1) Phase 1-Literature Survey,
In this phase, literature survey of water shed development technique will be carried out by internet browsing and referring Journals like ASCE,NICMAR Journals of construction of management, Journals of civil engineering and construction review, guidelines for water shed development given by govt, of Maharashtra.
- 2) Phase 2-General Survey,
 - water resources and requirement.
 - socio-economic survey.
 - to know the population, number and type of animals.
- 3) Phase 3-Watershed Development Measures,
Calculation for design and approximate cost required for water shed development measures.
- 4) Phase 4- The geo-coding of the SOI Toposheet and the satellite imagery was done using the IGIS software. The generation of the thematic layers like land Use Land Cover, Hydro geomorphology and Soil was done in Arc GIS software. The Geohydrology model of the Arc GIS software v\as used for proposing the soil and water conservation structures in the watershed.This data generated in the Arc GIS was later compared in the field for any corrections and deviations.

A. Data Collection

- 1) IRS P6 LISS-III
 - 2) Survey of India topographic sheets (46P/8)
 - 3) Field observations-structures, type of crops, Lat-long etc
 - 4) Ancillary data
- IRS P6 - LISS III data were interpreted for physiographic and land use patterns. Visual interpretation supported by digital analysis was done to form the soil legend and land use, legend also prepared. The interpreted data was taken to the field and systematic ground truth collection was done.



V. WATERSHED AREA DETAILS



Map No 1: Location of phulambri taluka in Aurangabad District.

The location or village code of Sonari Bk village is 548669. It is located in phulambri tahsil of Aurangabad district in Maharashtra, India. It is situated 25 km away from sub-district headquarter, Phumlambri and 52 km away from district head quarter Aurangabad. It is also a grampanchayat. Total geographical area of village is 145.73 hectares. Sonari has population of 473 people among which there are 261 males and 212 female and there are 104 houses. The connectivity to the village is only the public bus service which is available in the village. The railway station is available in 10+km from the village. The area of watershed is 414.98 ha. The geographical parameters are U.L. Longitude 75°22'E to U.R. Longitude 75°27'E and U.L. Latitude 20°13'30"N to U.R. Latitude is 20°12'N. Survey of India toposheet number 46 p/8 with scale of 1: 50,000 from the data obtained from ArcGIS. .

A. Rainfall

Rainfall in the country typically monsoonal in nature. In sonari village, phulambri tahsil it varies from 160mm to 700 mm with average yearly rainfall 460mm. The climate of the region is characterized by a hot summer and a general dryness throughout the year except during the southwest monsoon season which is from June to September. The average rainfall taluka phulambri is 614mm with average 35-36 rainy days as per rainfall data of last 14 years. Average annual rainfall is 710mm. The climate of the district is characterized by a hot summer and a general dryness throughout the year except during the south west monsoon season, which is from June to September while October and November constitute the post monsoon season. The winter season commences towards the end of November when temperatures begin to fall rapidly.

December is the coldest month with the mean maximum temperature of 28.9° C, while the mean minimum temperature is 10.3°C. From the beginning of March, the daily temperature increases continuously. May is the hottest month with the mean maximum temperature of 39.8°C and the mean minimum temperature of 24.6° C. With the onset of the south-west monsoon by about the second week of June, the temperature falls appreciably. Except during the southwest monsoon season, when the relative humidity is high, the air is generally dry over the district.

Rainfall, Aurangabad district, Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Aurangabad	629.0	792.7	711.6	677.2	937.4	552.4	746.62	731.7	802.9	668.8	737.51
Gangapur	440.3	203.3	657.4	499.9	918.2	619.8	533.55	539.2	721.2	491.3	571.31
Kannad	594.7	440.8	496.2	506.4	971.1	537.7	626.09	621.8	839.9	535.4	655.80
Khuldabad	932.9	761.3	717.9	481.1	963.8	562.9	614.73	635.6	868.5	523.6	660.61
Paithan	586.9	578.6	787.6	512.3	873.2	545.1	672.67	755.8	967.1	694.6	772.54
Phulambri	497.0	603.2	445.4	494.2	681.8	627.9	841.46	670.1	1136.4	580.5	807.12
Sillod	758.6	648.9	624.7	482.2	1085.6	644.5	501.82	750.8	961.7	709.6	730.98
Soygaon	814.2	1035.3	694.6	651.2	1010.4	682.9	669.1	872.5	917.1	644	775.68
Vaijapur	405.0	255.0	484.4	445.8	843.1	538.0	658.7	650.1	773.4	454.7	634.23

Table 1: Rainfall Aurangabad district

B. Availability of source of water

The source for water are phulambri lift irrigation scheme, dugwell and boarwells.

Perticular	Ponds	Wells	Bore wells
NO. of str.	2	21	45
Use limit	Public	Private	Private
Use for drinking purpose	Yes	YES	YES
Use of irrigation purpose	50%	YES	YES
Availability of water for drinking purpose	Till Dec-Jan	Till Nov-Dec	Til Nov-Dec
Availability of water for irrigation purpose	Till Dec	Till Jan	Till Feb

Table 2: Present status of ground water structure in watershed (tentative data).

VI. MAP DETAILS

While reclassification of the different maps, ranking values ranging from 1 to 5 were assigned for different classes within each map. Prior to reclassification, all the nine thematic maps in the vector format have to be rasterised. All the maps are in vector polygons. Rasterisation of vector polygon can be done using ERADAS and ArcGIS After rasterisation, reclassification of Drainage density, Lineament density map is done using reclassify.

Following are the different thematic maps which show their characteristics:

A. Contour Map

A contour map was prepared using the Survey of India topographical sheets on 1: 50000scale. A digital terrain model was created using the contour map. The distance between two contours is taken 20m. Contour will helps to find out ground elevation level. Map is giving the details of ground level.

B. Drainage Map

A drainage map is actually a map of drainage basin showing the total surface area, upstream of a point on a stream, where the water from rain, snowmelt or irrigation which is not absorbed into the ground flows over the ground surface, back into streams, to finally reach that point. The drainage map details showing in map.

C. Settlement Map

In the study area where the permanent structure. It is known as settlement structure. Settlement map showing settlement structure of that particular boundary and it include such as tree, structure etc.

D. Geology Map

The fractured and weathered basalt has been given the highest priority as it provides the necessary permeability and storage space. Massive basalt is not favourable as it is impermeable and cannot provide space.

E. Geomorphology Map

Pediment follows moderate to gentle slopes in this area and considered as the most suitable geomorphic class because it checks the velocity of surface runoff and thus provides more chance of water accumulation. River terraces are given the next priority followed by streams and coastal plain are given the next priority followed by least.

F. Lineaments Map

Areas around the intersection of lineaments are considered to be favourable sites for accumulation of ground water d. o weaker zones. So many lineaments are present in study area. In the hard rock areas, the movement and occurrence of

ground water depends mainly on the secondary porosity and permeability resulting from faulting, fracturing, joints etc. The most obvious structural features that Arc important from the ground water point of view are the lineaments. In general, lineaments act as ground water carriers. And here they were mapped from the satellite image.

G. Soil Texture Map

The soil in study area is identified in the satellite data by their tone, texture, color and variation on brightness, coupled with filed checks. Fine-grained soils (clays) are commonly darker than coarse-grained soils (sands).

VII. DESIGN DETAILS

A. Excavation Detail:

Top dimensions of pond = 15m x 15m,

Bottom dimensions of pond = 9m x 9m

Depth of pond = 3

Side slope to excavation = 1:1

Side earthen bund details:

Top width = 0.9ms,

Height = 1.0m,

Side slope = 2:1

B. 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

C. 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).

VIII. RECOMMENDATION

A. Social Aspects

The awareness regarding usges of available water should be developed. As pr government rule maximum depth of bore well is 200 ft. if this rule is followed them ground water level is maintained. For the lherif season crops is Maize, Bajra, and Rabi season crops is Jawar. These crops are not cash crops. If the cash fruit like pomegranate, grapes, etc. are cultivated then economic condition of farmer is increased. Select the crops/fruit which are required minimum water. If drip irrigation and mulching are used for crop/fruit then 50% of water is saved.

B. Salt Removal from Lakes and Wells

due to excessive silting of lake and wells, water storage capacity as depleted. there is a 8 to 10 ft silt deposited .removal of silt at proper interval is necessary it increase water storage capacity of lakes and wells and resorviour.it also increase ground water level considerably. solid waste and silt must be cleaned and wells should be protected against such pollution so as to make use of available water.

C. Rain Water Harvesting

Rain water harvesting can be implemented so as to conserve available rain water. It can be utilize a when necessary.

D. Check Dam

There are insufficient check dam across the stream, and they are not in condition. They require regular maintenance.

E. Vanrai bandhara

It is low cast structure locally available soil and sand filled with cement bags.is bandhara is constructed with local people participation the cost of bandhara is very low cost. vanrai bandhara I constructed at 100 ft interval.

F. Forestation

Planting of tree in a methodical and planted manner and using them wisely to minimize the effect of reckless the deforestation can be adopted for as tool here.

Cost for watershed technique for sonai

Sr.No.	Type of structure	No of structures	Cost of structure	Total cost
1	Farm pound	2	53000	106000
2	Check dam	3	107500	322500
3	Vanrai Bandhara	3	15420	46260
4	Nala bunding	10	55000	550000
Total Cost				1024760

IX. CONCLUSION

In aurangbad district the demand for water is going on increasing with the increases in population. So the effort are made to increase recharging of water by varies water and soil conservation structures. Rain water is naturally and freely available source and which is properly utilized by means of water harvesting and recharging techniques.

- 1) perennial source of water is not available. If watershed development technique are implemented, it will result in increase in the living standard and economic condition of Auranagabad city.
- 2) for watershed development project runoff is very important factor. It is easy to make rise in water table, due to check to the flow of water or runoff. Runoff occur in nallas/streams.
- 3) Watershed management project can effectively solve problem of drinking water.
- 4) varies watershed measures like RWH, farm pond, check dam, vanarai bandhara should be implemented to cope up with the drought conditions.
- 5) Maintanance program for water storage structure should be done regularly like removing silt in the lake, wells and check dam it will result in increased water storage capacity of above structure and ground water table.
- 6) Watershed development projects is effective for decreasing demand of water from phulambri lift irrigation scheme and sonari village become self-depend from water supply point of view.

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