ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

# Detailed Investigations on Requirement of Water Harvesting Structures

**Palli Praveen Kumar**
**Post Graduate Student,**
**Department of Civil Engineering,**
**Annamacharya Institute of Technology and Sciences, Kadapa.**

**Dr. P. Sri Chandana, Ph.D**
**HoD,**
**Department of Civil Engineering,**
**Annamacharya institute of Technology and Sciences, Kadapa.**

*Abstract:*

***Water harvesting is important in the present days. Due to global warming temperatures are increasing,and rainfall is also not occurring in monsoon season. Because of this in Kadapa many areas became drought prone areas. In order to avoid this situation government is making policy to store water in rainy season. When the structures (dams,check dams,tanks,percolationtanks, mini percolation tanks) are not present the rainfall water will runoff and join in rivers, sea, so that it is not beneficial to local area when the rain water is not storing. So we have to construct water harvesting structures and store water so that ground water resources will increase. So in this project we perform surveying so we can findthat how many structures are present in different panchayats and what the rainfall data is and how we can suggest new structures by calculating the yield.***

***In this project our aim is to suggest government by finding the number of structures, if the structures need any repairs, need any proposals for new structures by calculating the capacity of structures and finding yield.***

## 1. INTRODUCTION

### GENERAL

Water is one of nature's most important gifts to mankind and is very much essential for human civilization without which no developmental activities are possible on earth. Our daily lives are built on water and shaped by it. Throughout the history of mankind, civilizations have flourished only where water has been respected. Water is our culture, water is our life. Life can only be sustained for a limited period if the intake is less than three liters per day. Eighty percent of the human body is formed of water and three fourth of the planet's surface is covered by water. It has been shown that human health improves with intake of water up to a consumption level of 100 lpcd. Water has always been fundamental to development in the form of food production and industrial activity.

### 1.1 UNDERSTANDING DROUGHT – AN INDIAN PERSPECTIVE

In India, drought is a frequent hazard striking in one part or the other. Its impacts are not only confined to arid and semiarid regions but often in potentially good rainfall areas too, which are otherwise productive (i.e. humid and sub humid rain fed agricultural areas). The National Commission of Agriculture (1976) reported that about one third of the geographical area of the country i.e. 107 million hectares spread over 99 districts in 13 states, was affected by droughts. The drought-prone areas of the Country are confined to peninsular and western India – primarily arid, semi-arid and sub-humid regions

### 1.2 WATERSHED

Can be defined as geohydrological unit where the rainwater is drained to a common point.

### WATER CONSERVATION STRUCTURESCOMMUNITY WORKS

- STAGGERRED TRENCHES (ST)
- WATER ABSORPTION TRENCHES (WAT)
- SUNKEN PITS

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

- DUG OUT PONDS
- DEEPENING & IMPROVEMENTS TO PTs
- DEEPENING & IMPROVEMENTS TO CDs
- MPT
- PERCOLATION TANKS
- CHECK WALLS
- CHECK DAMS

## 1.3OBJECTIVES

Our main objective is to avoid drought condition in our place .so we will study the rainfall details of vempallimandal,we will take few village panchayats and we will find the list of structures i.e: check dams,percolation tanks,minipercolation tanks, tanks which are already existing .we will find the rainfall,storage data and we can suggest number of structures which are actually needed so that we can store water and we can reduce the drought condition with minimum efforts. We will also find the necessity of the structure and design and estimate the check dam

## 2. STUDY AREA AND DATA COLLECTION CUDDAPAH DISTRICT

Cuddapah lies between the 13°43' and 15°14' Northern Latitudes and 77°55' and 79°29' of the Eastern Longitude. As per the 2001 Census (Provisional) the population of the District is 2601797 of which the Rural Population is 2014044 and the Urban Population is 587753. The density of population in the District is 169/Sq.K.M.

## RAINFALL

Normal annual rainfall: 696.2 mm
South west monsoon: 388.7 mm
North east monsoon: 231.3 mm

Cumulative departure from normal
Rainfall (for the last five years): - 27%

## LAND USE (Area in Ha):

Forest : 5, 05,495 (33%)
Barren and uncultivated : 2, 40,392 (16%)
Cultivable Waste : 71,000 (5%)
Current fallows : 54,351 (4%)
Net area sown : 4, 19,150 (27%).

## 2.1 STUDY AREA:

Vempalli region located in kadapa district of Andrapradesh is selected as study area. The index map of the study area is given in Figure 3.3. vempalli region, is one which is Covered under Drought Prone Area Programme (DPAP) in kadapa district as on November 2008. The study area lies between the 14° and 14°15' Northern Latitudes and 78°35' and 78°50' of the Eastern Longitude.

## 2.2 DETAILS OF MAJOR AND MINOR RIVER BASINS:

The river that flows through Rayachoti is Mandavya River and is named after

FIG.1INDEX MAP OF STUDY AREA

The Rishi Mandavya. Cheyyeru River is a tributary of River Pennar. It's also called BahudaaNadi. The nearby mandals to this river are Rayachoti, Nandaluru, Kodur. The coordinates of this river are: 13°59'4"N, 78°5

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

## 2.3 DATA COLLECTED

The data utilized in this study comprises of finding the structures already existing, details of their location and functionality. We have collected data in vempallimandalAlavalapadu,Muthukuru,Ramireddypalli,Thalapallivilllages.

### 2.3.1 Topographic Maps

The study area is resulted from the topographic map of Survey of India (SOI), viz., 57J7 at 1:50,000 scale. From these maps, information such as location of the villages, water bodies etc., are extracted and used as input data for database creation. These maps have also been used for dereferencing of the data.

### 2.3.2 Meteorological Data

Annual rainfall of study area is collected from the C.P.O office for the years 2006 to 2013 and the data is given in the below table.1

Table no1: Ground water data forVempali region in (hac-m)

| Sl.No. | Station | 06-07 | 07-08 | 08-09 | 09-10 | 10-11 | 11-12 | 12-13 |
|---|---|---|---|---|---|---|---|---|
| 1 | Vempalli | 1746 | 2276 | 2011 | 2356 | 2354 | 1796 | 1786 |

### 2.3.3 Objectives

- The broad objectives of Check Dams (In-stream Storage Structures) are:
- To provide drinking water facilities in the villages along both the sides of the river after monsoon period.
- Ground Water recharge
- To provide incidental irrigation during late Khariff and Rabi by storing water at the end of monsoon mainly through lifting devices Irrigation use of water flowing down drainage channels
- To divert water from perennial / semi-perennial streams in hilly areas for irrigation purpose.
- Other uses by villagers like bathing, washing, fishing, recreation etc. depending on location and potentiality.

### 2.3.4 Repairs - Check dam

Types of Repairs

1. Body wall Damage
2. Upstream Cutoff Damage
3. Solid Apron Damage
3. Downstream Cutoff Damage
4. Water Cushion Wall Damage
5. Talus Damage
6. Retaining Wall Damage.

### 2.3.5 Study details

| Habitation | Stream Local Name | Stream Number | Name of the Structure | Stream Number | GPS Coordinates | | Repairs Required |
|---|---|---|---|---|---|---|---|
| | | | | | Longitude | Latitude | |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Muthukur | MusaliGangammaGudiNorva | B1 | Check Dam | B1-CD1 | 78 37 51 | 14 45 00 | Major Repairs |
| Muthukur | ChinnaPeeruVanka | B2 | Check Dam | B2-CD1 | 78 38 67 | 14 46 21 | Major Repairs |
| Muthukur | Pala Vanka | B3 | Check Dam | B3-CD1 | 73 39 15 | 14 45 81 | No Repairs |


Fig 2: details in vempallimandal

## 3. METHODOLOGY

### 3.1 Plotting on SOI Sheet

We will find the exact location on SOI sheet by plotting according to obtained GPS coordinates

### 3.2 Calculating the catchment area

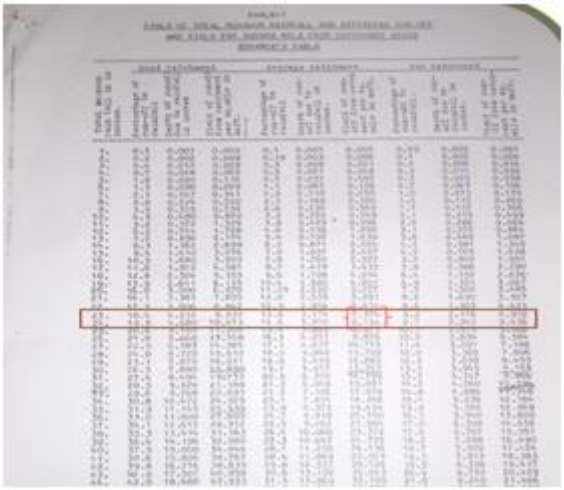
Calculating the catchment area by plotting the boundaries on the SOI sheet and transfer it to the graph sheet so that we can find the catchment area.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

### 3.3 Rainfall data

Rainfall data for the last 40 years and we will average fall data for the proposed Mandal.

### 3.4 Strangers Table



### 3.5 Maximum Flood Discharge

From the yield and catchment area we will find total discharge.

As per DICKEN's formula

Maximum flood Discharge Q = CM3/4

Where, C = DICKEN's Constant = 1000

M = Catchment Area

Q = 1000 × (0.68) 3/4

Q = 748.82 cusecs

Q = 748.82/35.315

Maximum flood Discharge Q = 21.20 cusecs.

For HC Weir, Q = 2.95Cd L H3/2

Assuming L = 12 m

Cd = 0.73 (constant)

Q = 2.95 Cd L H3/2

21.20 = 2.95 × 0.73 ×12× H3/2

H3/2 = 21.20/ (2.95 × 0.73 × 12) 3/2

H3/2 = 0.820

H = (0.820)2/3

H = 0.876

H = 0.9 m

### 3.6 Design

We will follow hanumantharao guidelines and select design parameters.

### 3.7 For example:

MUTHUKURU:

CHECKDAM 1:

Longitude - 78°22'30.36"

2' = 2 × 3.6 = 7.2 cm

30.36" = 30.36 × 0.06 = 1.82 cm

Total =9.02cm

Latitude - 14°27'00"

2.7' = 2 × 3.7 = 7.4 cm

00" = 0 = cm

Total = 7.4 cm

### 3.8 Free Catchment area

SI sheet (or Topo sheet)

Scale 1:50,000cm

1cm=1:50,000cm

=0.5km

1Sqcm =0.25Sqkm

1 Mile= 1.6Km

1 km= 0.625 Mile

1 Sqkm =0.390Sqmile

### 3.9 Calculations: (From graph)

1.4 Sqcm ,13-0.25 Sqcm ,2.19 Sqcm

=3.25Sqcm

Total = 4 +3.25+2.19

=9.44 Sqcm

=9.44*0.25

=2.36Sqkm

=2.36*0.390

Free Catchment area =0.92Sqmiles

2. 4 Sqcm 8-0.25sqcm, 100Sqmm=1Sqcm=2Sqcm

Total

=4+2+1 =7 Sqcm

=0.25*7

=1.75Sqkm=1.75*0.390

Free Catchment Area =0.68Sqmiles

3. 1Sq cm , 5- 0.25 Sqcm ,1.38Sqcm

Total = 1+1.25+1.38= 3.63 Sqcm

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

=3.63*0.25
=0.9075 Sqkm
=0.9075*0.390
Free Catchment area =0.353Sqmile

Free Catchment Areas From Graph:

Free Catchment Area = 0.92 sq.mile
Free Catchment Area = 0.68 sq.mile
Free Catchment Area = 0.353 sq.mile

### 3.10 Storage Capacity of Check Dams:

Check dam
Length of Body wall =8.5m
Height =1.3m (Silt Factor=0.2m)
=1.1m

→Foreshore of Check Dams = 250m (approximately)
→Storage Capacity = Length *Height *Foreshore
=8.5*1.1*250
Storage Capacity =2337.5m3

### 3.11Yield at Site

Rain GuageStation:Vempalli
Period Considered: From 1973 to 2012
Average Monsoon Rainfall: 606mm (23.86")
So, from "Stranger's Table"
Yield of run-off from catchment in "Mcft/Sq-mile"
(23.86")→ 23 – 7.374
24 - 8.154
By performing Interpolation
=7.374 +((8.154-7.374)÷(24-23))*0.86
=8.0448 Mcft/Sq.Mile
Therefore the yield is calculated as per influencing rain gauge located at Vempalli as per storage table method for average catchment area yield per sq.mile for 50% dependable rainfall is 8 Mcft/Sq.Mile
˝Total Yield available at site =8*0.68
=5.44 McFt

### 3.12 Design of Body Wall

As per HanumanthaRao Guide Lines,
Height of Body wall =1m
Base width of body wall=1.2m
Length of 1st Apron =4.3m
Length of 2nd Apron =3.7m
Thickness of 1st Apron =0.6m
Thickness of 2nd Apron =0.45m
Depth of Upstream Cut-off =1.8m
Depth of Downstream Cut-off =2.2m
Length of Talus =3.3m

### 3.13Hydrological Particulars

Top Level of Solid Apron =97.37m
Full Tank Level=98.37m
Mean Water Level =99.27m
Total Bund Level= 99.57m
Length of the body Level = 12.00m

### Stability calculations

Table2: Stability of abutment

| S.No. | Load | | | | | | | Lever arm | Moment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | $W_1$ | 0.6 | x 0.6 x | 2.40 | = | 3.02 | | 0.300 | 0.9072 |
| 2 | $W_2$ | 0.5 | x 0.8 x | 2.10 x 2.4 | = | 2.02 | | 0.867 | 1.7472 |
| 3 | $P_H$ | = | wxH²/6 | | = | | | | 1.54 |
| | | | | | Total= | 5.04 | | | 4.20 |

$$\text{Resultant} = \frac{\text{Total moment}}{\text{Total load}} = \frac{4.2}{5.0} = 0.8$$

Therefore position of the resultant falls within middle third of base 0.467 to 0.933. Hence safe

### 4. CONCLUSION

Drought monitoring and forecasting are essential tools for implementing appropriate mitigation measures in order to reduce negative impacts. From the calculations of

- IMD method, we have obtained moderate drought.
- SPI method, we have obained mild and moderate drought.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

- ADSI method of agricultural drought assessment, we have obtained moderate and severe droughts.
- GRI method of hydrological drought assessment, we have obtained moderate and severe droughts.
- From land use and land cover map most of the land is occupied by agricultural land and barren land.

We have forecasted the future values by using all these methods on the basis of past values.

## 5. REFERENCES

1. Drought in Syeria: "An assessment of impacts and options for improving the resistance of the poor", A journal of international agriculture (2012) by Perrihan Al Riffai and ClemansBreisinger,Vol .1,21-49.

2. "Drought assessment using GIS and Remote sensing in Amman-Zarga basin zordan" by NezarHammouri and Ali El-Naqa, A jordan journal of Civil Engineering, Vol.1, No.2, 2007.

3. "Remote Sensing, crop yield estimation and agricultural vulnerability assessment: a case study of southern Alberta" by xiaomengren, wexer and anne smith, A open hydrology journal, 2012, vol: 6, 68-77.

4."Drought forecast model and frame work using wireless sensor networks by hsu-yang kung,jing-shiuanuaabdchaur-tzuhnchen, a journal of information science and engineering vol:22,751-769(2006)

5."Assessing environmental and health impact of drought in the north west, Bangladesh" byn.c.dey ,m.s.alam,a.k.sajjan,m.a.bhunjan,L.ghose.y,ibaraki, f.karim, A journal of environmental science and natural resources 4(2):89-97,2011.

6. "A Climate change analysis and adoption: the role of remote sensing and geographical information system (GIS)", by nathanidbayodeenilorunda, an International Journal of Computational engineering research vol: 4 issue 01

## Author Details

**Palli Praveen Kumar**
Post Graduate Student,
Department of Civil Engineering,
Annamacharya Institute of Technology and Sciences,
Kadapa.