Volume : 1 | Issue : 6 | June 2012 ISSN - 2250-1991

Research Paper Engineering

Artificial Recharge by Using Rainwater Harvesting- A Case Study of a Check Dam in Zalod, Dahod Area

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ABSTRACT

Water is a prime natural, a basic human need and a precious national asset. It has to be treated as a valuable national resource. Increasing demand and decreasing availability of fresh water is bound to result in severe water scarcity in near future. Some parts of the world are already recognized as water-scare areas while water scarcity in other parts is predicted to be round the corner. One third of the countries in water-stressed regions of the world are expected to face severe water shortage this century. By 2025 there will be approximately 6.5 times as many people a total of 3.5 billion living in water stressed countries.

India is one of the countries In the world in terms of average annual rainfall, yet there are problems of distribution of surface water, both spatially and temporally with wide variations. Hence, there is a need for comprehensive analysis of the country's groundwater resources. India is a country of geographical diversities. The diversities have their own impact on the groundwater occurrence in different areas.

The water resources of India are drawn from 19 major drainage basins. Small river basins are divided into four major drainage areas. Gujarat has very limited water resources. The characteristic feature of the rains in Gujarat is the variation of precipitation. Its occurrence in a short spell of the year and its variation are erratic not only during monsoon but also varies from region to region. The state's total surface water resources work out to 2-3 percent of the water resources of India.

From the water resources consideration the state of Gujarat can be divided into four major physiographic regions consisting 185 river basins distributed, river basins belonging to North Gujarat, river basins belonging to Central and South Gujarat, river basins belonging to Kachachh and river basins belonging to Saurashtra.

Panchmahal district lies between 200 30' to 230 30' north latitudes and 730 15' to 740 30' east longitudes. They study area located in Zalod taluka of Dahod District. The nearest railway station to reach the taluka place is Dhahod, which is about 35 km from Zalod. Zalod is connected with district head quarter Dahod by state Highway-58. Zalod is also connected by the road with Kushalgadh and Banswada the prominent places of Rajasthan. Machhan River flowing from south-west direction and mainly drains from the area of Dhahod District. The overall topography of the region is highly undulating and of varying slopes. The elevations of the area vary from maximum 360 meter to minimum 200 meter with respect to mean sea level. The annual rainfall in the area varies between 800 mm to 1000 mm. in general the depth to water level in Zalod taluka from 1.2 to 21.5 m B.G.L. In general the depth of the water level broadly the follow the surface topography and the drainage pattern in the area.

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Introduction

Water exists in its three forms: gaseous, liquid and solid. It is circulated mainly by solar and planetary forces. The sun provides the energy for the evaporation of sea water.

Earth gravitational field and carioles (combination of different forces) forces contributes to the circulation of water. The group of numerous different paths through which the water in nature circulates and is transformed is known as hydrological cycle.

About 97% of the total available water on earth is contained in oceans, and hence it is saline or salty in nature. The amount of fresh (sweet) water actually available is only about 3% of the total quantity of water on the (Table No.1.1). Out of the 3% , which is available as fresh water, about 2% is contained as ice on poles, and about 0.75% as ground water. Out of the remaining 0.25%, only 0.01% is available in lakes and rivers and remaining is available as glaciers and snow.

Table : inventory of Water At The Earth's Surface.

Reservoir	Volume (km3 x 1,000,000)	Percent of Total
Oceans	1370	97.25
Ice Caps & Glaciers	29	2.05
Groundwater	9.5	0.68
Lakes	0.125	0.01
Soil Moisture	0.065	0.005
Atmosphere	0.013	0.001
Streams and Rivers	0.0017	0.0001
Biosphere	0.0006	0.00004

Water Resources of India :- dia is one of the wettest countries in the world in terms of average annual rainfall, yet there are problem of distribution of surface water, both spatially and temporally with wide variations. Hence, there is a need for comprehensive analysis of the country's groundwater resources. India is a country of geographical diversities. With the Himalayas as in the north, the land stretches on all sides enveloping the extensive northern plains, the sand of the Thar on the west, Assam hills on the east the uneven plateau surface ancient hills and coastal plains on the south. The country has an opportunity to have an abundance of sunshine from the sun due to tropical locations and the erratic rains from the monsoons.

Water Harvesting: - Water can be harvested in different ways,

- For individual houses, they can trap rain water and store it in underground tank.
- For a group of houses having well for fulfilling there daily need, it can be recharged by diverting rain water into it.
- For villages, people can make artificial obstruction in nearly Taluka called check dam) store the rain water and use for irrigation and other purpose.

Objectives of the Study

The main objectives of the study are:

- Study of region and water harvesting structures constructed in and around the region.
- Study of rainfall characteristic and pattern of the region.
- Study of Ground water table fluctuations in observation well located in the area.

Study Area

Gujarat state is situated between 200 06 and 240 42' North Latitude and 680 10' and 730 28' East Longitudes in the western part of India. It covers a total geographical area of 1,95,984 km2 Out of the total area nearly 1,09,314 km2 is occupied by rocky formation and 86,670 km2 is by alluvium; of which 34,625 km2 is saline area. The State has the longest coastline in the country measuring about 1,600 km along the western part of India. Being located on the Tropic of Cancer, Gujarat falls in the sub- tropical climatic zone and a large part of the state lies between 350 C and 450 C isotherms.

Irrigation by Different Sources

Sr. No.	Taluka	Medium Irrigation Project		Minor Irrigation Project		Big CD		Small CD	
		No.	Irr. Area	No.	Irr. Area	No.	Irr. Area	No.	Irr. Area
1	Dahod	1	4467.7	8	1180	0	0	394	3994.87
2	Jhalod	2	3675	20	3882	3	1853	1680	7264.526
3	Limkheda	2	2997.3	10	1295	0	0	1126	4598.045
	Total	5	11140	38	6357	3	1853	3200	15857

Irrigation by Different Sources

Sr. No.	Taluka	percolation Tank		L.I.Scheme		Tank at safe storage		Total Irrigation area by all (Ha.)
		No.	Irr. Area	No.	Irr. Area	No.	Irr. Area	
1	Dahod	10	148	40	1784.703	23	275	11850.29
2	Jhalod	19	356	72	3860.526	12	146	21037.05
3	Limkheda	8	196	33	1837.247	3	40	10963.59
	Total	37	700	145	7482.476	38	461	43850.93

Land Use pattern (Area in Ha.)

Taluka	Cultivable land	Non Cultivable land	Forest	Pasture Land	Waste land	Other	Total Area
Dahod	39547.38	15192.4	7977.12	2093.11	2639.86	1465.33	68915.20
Limkheda	34755.57	4517.93	16881.30	2303.87	7354.07	3135.84	68948.58
Jhalod	50526.5	9128.41	13787.12	4372.27	3917.57	1516.33	83248.20
Total	124829.5	28838.74	38645.54	8769.25	13911.50	6117.50	221111.98

Cultivable and irrigated land In Dahod District

Sr. No.	Taluka	Total cultivable land	cultivable land	Irrigation Land	Total Area
1	Dahod	39547.38	37904.86	11850.28605	69369.69
2	Limkheda	34755.57	34755.57	10963.5915	69366.76
3	Jhalod	50526.5	49084.88	21037.05263	83248.19

GW Development Potential

Taluka	Gross GW Recharge	Utilizable GW Rehcarge	Total GW Draft	Gross GW Balance	Level of GW Development %
Dahod	68.73	54.98	11	43.98	20.01
Jhalod	56.59	45.27	24	21.27	53.01
Limkheda	77.87	62.3	25.87	36.43	41.53

Salient Features of Dahod Check Dam

Gross	Crest	Height (m)	FSL (m)	Bed	Catchment
Length (m)	Length (m)			Level (m)	Sq.Mile
95.25	57.5	3	96.25	93.25	158.95

Artificial Recharge Techniques
Direct methods
1. Surface spread techniques
1. Flooding
2. Ditch and Furrow
3. Basins
4. Stream channel modification
5. Over irrigation

Direct sub-surface methods
In direct sub-surface methods, the water is conveyed and recharged directly into an aquifer.

These are classified as
a) Recharge Pit
b) Percolation Pit
c) Percolation Pit With Bore Method
d) Recharge Trenches
e) Recharging of service tube well
f) Recharge of dug well and abandoned dug well
g) Modified Injection wells,
h) Recharged Trough
i) RWH through Continuous Contour Trenching
j) RWH through Percolation Tank
k) Aquifer Storage and Retrieval (ASR);
l) Soil Aquifer Treatment (SAT)

2. Indirect methods
Induced Recharge by
(1) Pumping wells;
(2) Collector wells;
(3) Infiltration gallery

Aquifer Modification by
(1) Bore Blasting;
(2) Hydrofracturing

3. Combination methods
Groundwater conservation structures as
(1) RWH Through Check Dam, Groundwater dams, underground bandharas;
(2) Fracture sealing cementation technique

Direct Surface Methods
1) Flooding
2) Ditch and Furrow
3) Basins
4) Steam channel modification
5) Over irrigation

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g) RWH through Continuous Contour Trenching
h) RWH through Percolation Tank
I) Open well Recharging by Soak Pit Method (Center Of Science for Villages
j) RWH through Check Dam:

Subsurface Techniques
1) Recharge of dug well and abandoned dug well
2) Modified injection Well

3. Combination methods
Components of Rainwater Harvesting Structure
1. Catchments
2. Gutter
3. Conduit:
4. Course mesh
5. First Flushing
6. Filter:- Below the just name of the Filter.
a) Dewas Filter
b) Sand Filter
c) Filter for large roof top
d) Horizontal Roughing filter
e) Slow sand filter

Conventional and Unconventional Techniques of Artificial Recharge:
1. Fracture Seal Cementation (F.S.L)
2. Bore Blast Technique (B.B.T)
3. Pereferial Jacket Blasting (P.J.B)
4. Syphon Recharge
5. Self Recharge Trench Bore
6. Hydrofracturing

CONCLUSIONS
- The study of rainfall pattern shows that the average rainfall of the region has increased in Jhalod Taluka to 955 mm and decreased to 769 in Dahod taluka compared to 870 mm of last 50 years.
- The rainfall pattern is highly erratic and number of rainy days in all months of the rainy season are less than 60 % (even, 60 % in many cases) for most of the years of last decade. It is noticed that inspite of rainfall ground water level has risen.
- Many check dams constructed in the region of heights varying from 1.5 to 2.5 m and having capacity of 2 to 15 MCFT. Farmers practice lift irrigation from this check dams especially during big gap between two rainfalls to save kharif crop. This not only saves crop but also recharges ground water.
- Irrigation is practiced from the storage of check dams by Lift Irrigation Schemes. Area irrigated mainly depends upon amount of storage which in turn depends on rainfall. Even during Years 2000 to 2002, years of consecutive severe drought some amount of irrigation has been noticed.
- In 2002 the villagers constructed a pipeline system to bring drinking water on tap from the wells near check dam. Villages also control the use of water through the local village institutions called lift irrigation committee. Due to the construction of check dam, the agriculture yield also increased, today formers irrigated about 100 acres of land
- According to the study conducted there observed a significant rise in average crop yield in the period of more than last one decade compared to rising trend of earlier period. This clearly shows impact of check dams. Also there is noticeable increase in the cultivated land, which confirms the same fact.

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