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REVIEW PAPER ON ARTIFICIAL GROUND WATER RECHARGE, MANSA

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Abstract: Artificial recharge of groundwater is attained by putting surface water in basins, furrows, drains, other facilities where it penetrates into the soil and moves downward to recharge aquifers. Groundwater plays a dynamic role in the country in increasing food and agricultural production, providing drinking water and facilitating industrial development. In most of the states the ground water removal has surpassed annual recharge and water table has gone down. In order to recover the ground water situation it is necessary to artificially recharge the washed-out ground water aquifers. In this work, selective techniques of estimating artificial ground water recharge are outlined which can be adopted to increase the ground water level. Mansa is the taluka of Gandhinagar District is also suffering from shortage of water and quality of water. The study is useful to know effectiveness of artificial recharge in water level and water quality.

Keywords: Water table, Nwater Recharge, Aquifer, Runoff, Precipitation

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INTRODUCTION

Artificial recharge may be defined as "The practice of increasing the amount of water that enters a ground water reservoir". Ground water is the water present beneath earth's surface in the soil pore spaces and in fractures of rock formation. There are three different types of ground water 1) meteoric water which is the rain droplets that seep down into spaces between the rocks, 2) connate water these liquid that were trapped in the pores of sedimentary rocks & 3) magmatic water which was formerly chemically bound up in minerals. The 60 % ground water of the earth is used for the irrigation and rest of the 40% is useful for households and industry.[1, 2]

Now a days water requirement is satisfied by various methods such as Artificial Groundwater Recharge. so it required and profitable technique for various purposes like growing of crop, Use for Public, Industries etc. Artificial groundwater recharge can be done through various methods. Groundwater recharge is necessary due to increase in popularity day by day. The primary objective is to collect and store water in ground for use and future purpose. [1, 2]

Artificial recharge means man made process specifically designed for primary purpose of increasing the amount of water entering into a groundwater table.
We select the study area of Mansa. The current problem is inadequate rain and low water level affected whole city. We study for Artificial Groundwater Recharging in Mansa [1,2](http://www. navodayaengg. in).

OBJECTIVES

Objectives of Artificial Groundwater Recharge are as follows:-

1. To increase groundwater table by artificial groundwater recharge method.
2. To use the rainwater for recharging.
3. It helps to increase safe yields.
4. In rainy season, instead of surface runoff flow out and join to sea water, this water may store in underground reservoir by artificial recharge.
5. Artificial recharge may increase level of water in underground reservoir Thus reduce cost of pumping.

STUDY AREA

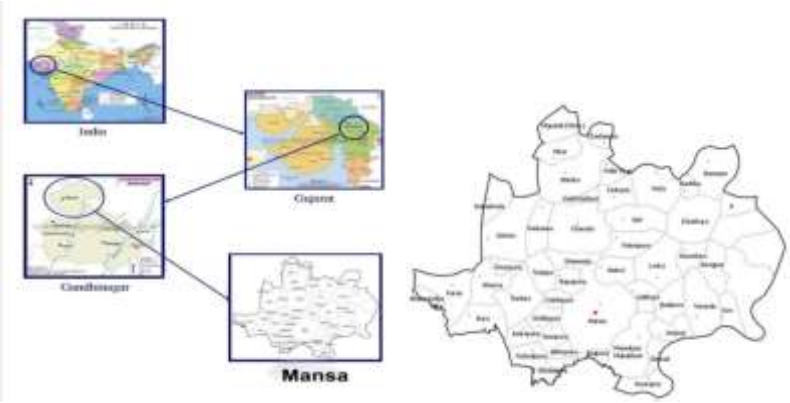

Fig 1 Mansa(Source: - http://imagesaarogya.com/)

Mansa is taluka of Gandhinagar, Gujarat Mansa is located at 2343^{0}N &7267^{0}E. It has an average elevation is 94m (308ft) Population of Mansa is 225930 (2011 census). According to Bureau of Indian Standards Mansa city is under seismic zone III

MATERIALS AND METHODS

Table1 :- Developing Urban Areas (Source: www.wcc.nrcs.usda.gov)

Cover description	Curve numbers for hydrologic soil group			
	A	B	C	D
Newly Graded Areas (pervious areas only, No Vegetation)	77	86	91	94

Table2 :- Cultivated agricultural lands(Source: www.wcc.nrcs.usda.gov)

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment	Hydrologic Condition	A	B	C	D
Fallow	Bare Soil	-	77	86	91	94
	Crop Residual Cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Small Grain	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR+CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88

		Good	65	75	82	86
	C+CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured &	Poor	66	74	80	82
	Terraced (C&T)	Good	62	71	78	81
	C&T+R	Poor	65	73	79	81
		Good	61	70	77	80
Close – seeded or broadcast	SR	Poor	66	77	85	89
legumes or rotation		Good	58	72	81	85
meadow	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

Table3:- Other agricultural lands (Source: www.wcc.nrcs.usda.gov)

Cover description		**Curve numbers for hydrologic soil group**			
Cover Type	**Hydrologic Condition**	**A**	**B**	**C**	**D**
Pasture, grassland or range – continuous forage for cropping	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow – continuous grass, protected from cropping and generally cut for hay	-	30	58	71	78
Brush – weed – grass mixture with brush the major element	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods – grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79

	Good	30	55	70	77
Farmsteads – buildings, lanes, driveways and surrounding lots	-	59	74	82	86

METHOD

Direct Methods:-

A. Flooding:-

This method is right for relatively flat topography. It requires a system of delivery channel for the supply of water for flooding. Higher rate of vertical infiltration is obtained on areas with uninterrupted plants and sandy soil covering

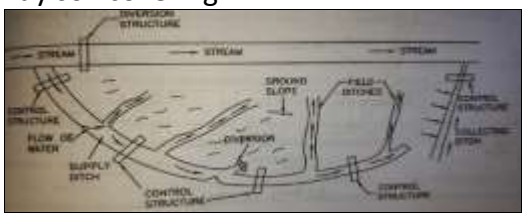

Fig 2 Flooding Method (Source: Hydrology and Water Resources Engineering book by Dr Dhruvesh Patel)

B Recharge Basins:-

Fig 3 Recharge Basin Method
(Source: mavensphotoblog.com/wp-content/uploads)

Artificial recharge basins are either excavated or enclosed by dykes or levees. They are commonly built similar to temporary or damaged stream channels. The water contact area in this method is quite high which normally ranges from 75 to 90 percentage points of the total recharge area. In this method, efficient use of space is made and the shape of basins can be adjusted to suite the territory condition and the available space.

Sub-Surface Techniques:

A Injection Wells:-

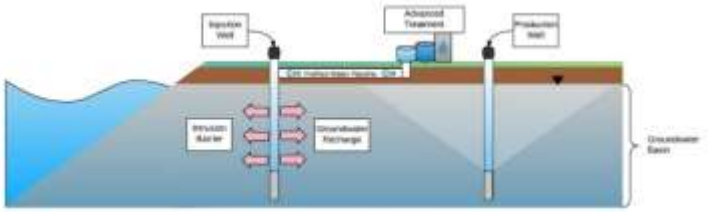

Fig 4 Injection Well Method
(Source: waterinthewesstanfordedu/groundwater/img)

Injection Wells, where water is "pumped in" for recharge. The Injection Wells are like to a tube well. This method is suitable for increasing the ground water storage of deeper aquifers by "pumping on" treated surface water. These wells can be used as pumping wells during summer time.

B Gravity - Head Recharge Wells:-

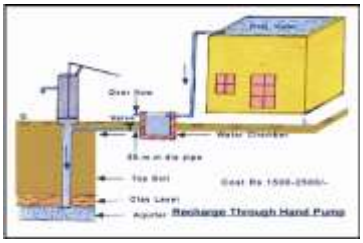

Fig 5 Gravity – Head Recharge Wells (Source: www.nipstec.com/images)

Boreholes and wells can be used as recharge structures. This method is appropriate where land availability is limited and the aquifer is deep and overlain by impervious strata. The rooftop rainwater flows to the well and recharges under gravity. Recharge water should be silt free. This method is most suitable for areas where the groundwater level is deep.

C Recharge Pits:

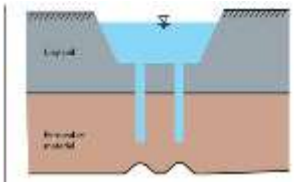

Fig 6 Recharge Pit Method (Source: ntplac.in/courses/105103026/module4/lec29/images)

The area in which impervious layer come across at where water depth is not deep and the pits are suitable structure for artificial recharge. These structures are cost effective to recharge the aquifer directly. Diameter of pit should normally be more than 2m to accommodate more water. A silt free source water can be put into recharge shaft / pit through pipes, if this pipe is kept above water table there are chances of blocking of the aquifer by air bubble with water therefore it is always suitable to lower the injection pipe below the water level.

Indirect Methods:

A Induced Recharge:-

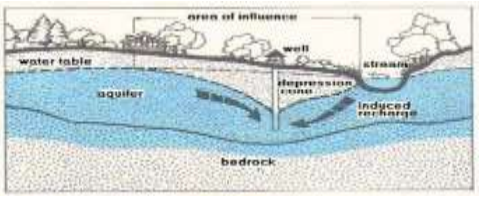

Fig 7 Induced Recharge Method (Source: wellwateroregonstateedu/sites/wellwateroregonstateedu/files)

It is a method of artificial recharge involving pumping from aquifer hydraulically connected with surface water such as perennial streams, unlined canal or lakes. The heavy pumping lowers ground water level and it creates cone of depression. Lowering of water levels makes the surface water to fill the ground water.[3,4,5]

B Collector Wells:-

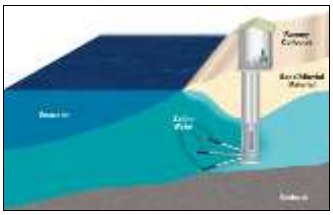

Fig 8Collector Wells Method (Source: www.scwd2desal.org/images)

For obtain very large water supplies from river-bed, lake-bed deposits or waterlogged areas, collector wells are constructed. The largest discharge and lower lift heads make these wells economical even if initial capital cost is higher as compared to tube well. Collector well with horizontal lateral and infiltration gallery can get more induced recharge from the stream.

C Infiltration Gallery:-

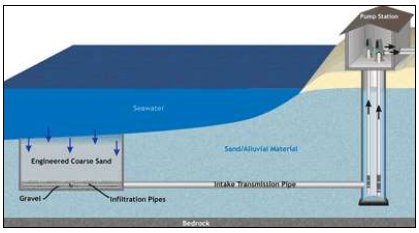

Fig 9 Infiltration Gallery Method (Source: www.sced2desal.org/images)

Infiltration gallery is other structure used for tapping groundwater reservoir below riverbed strata. The gallery is a horizontal perforated or porous structure (pipe) with open joints, surrounded by a gravel filter envelope laid in permeable saturated strata having shallow water table and a perennial source of recharge.

RESULT AND DISCUSSION

By the study area of Mansa city we get conclusion that it soil type is Sandy Loam type soil and its crop type is a fallow type crops. For this project we get data of 30 years rainfall in Mansa's city. Raipur Weir and after analysis of rainfall data we calculate the runoff by SCS Curve Number Method. After this we do ground water level data collection and analysis in 8th SEM. Also calculation of artificial recharge by simulation method.

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