

**GROUNDWATER STATUS IN GUL RIVER BASIN OF CHOPDA
TAHSIL OF JALGAON DISTRICT (MS)**

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Abstract

Water is a basic or fundamental need of human being as well as animals and vegetations. Water is main resource responsible for changing human civilization. Water resources are sources of water that are useful to all of us. Uses of water include – domestic, agricultural, industrial, recreational and environmental activities. Groundwater occupies a great importance in human life. Utilization of groundwater for agriculture, industry and domestic purposes is highly than other sources. Main objectives of the proposed research was to examine the status of groundwater table in the watershed area of Gul river. Proposed research work will be made on primary and secondary data. Primary data collected from field survey of wells, tube wells and bore wells. Current status of water table occurred in tube wells was 74.56 mt and in wells was only 12.27 mt bgl. High level difference occurred in water table of that region that was constructed wells or tube wells. This difference was 62.29 mt between the wells and tube wells . The difference occurred in water table of groundwater between present and on construction of wells was 4.96 mt . The study concludes that- the impact of Project reservoir on the groundwater table in the command area of the Gul Medium Project.

Key Words : Groundwater, River Basin, Potentiality, Watershed Area, Command Area.

Introduction :

“Resources means materials or substances occurring in nature which can be exploited for economic gain.”

Natural resources are resources that exist without actions of human kind. On the earth, sunlight, air, water, soil, vegetation, animals and minerals are the natural resources.

Water is a basic or fundamental need of human being as well as animals and vegetations. Water is main resource responsible for changing human civilization. Although the principle of

conservation of mass would stipulate that the total quantum of water will remain unchanged over time, that the availability of usable quantity water per person is changing adversely in the world.

Water resources are sources of water that are useful to all of us. Uses of water include – domestic, agricultural, industrial, recreational and environmental activities. The majority of human uses require fresh water. On the earth total 97 per cent of the water is salty water in oceans. Only 3 per cent water is fresh water, slightly over 2/3 of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground (surface runoff, lake, reservoir etc.) or in the air (vapor).

Groundwater is by far the most abundant and rapidly available source of fresh water, followed by lakes, reservoir, rivers and wetlands. According to WRI, UNEP, World Bank in1998, about 1.5 billion population depend upon the groundwater for their drinking water supply. Ground water represents over 90 per cent of the world's rapidly available fresh water resource.

The amount of groundwater withdrawn annually is roughly estimated at 600 to 700 km³, representing about 20 per cent of global water withdrawals (NMO, 1997). A comprehensive picture of the quantity of groundwater withdrawn and consumed annually around the world does not exist.

Objectives Of The Study:-

Main objectives of the proposed research work are as following –

- 1) To examine the status of groundwater table in the watershed area of Gul river.
- 2) To assess use of wells and tube wells for irrigation.
- 3) To assess improvement in irrigation due to percolation of Gul Dam in the study region.
- 4) To study the suitable cropping pattern in the study region.

Research Methodology:-

- **Sample :** Here researcher decide and identified total 60 numbers of wells, tube wells and bore wells was the selected sample for the conducting field survey. Out of them 27 was

wells and 13 was tube wells or bore wells. For the purpose of Sample selection, Stratified Random Sampling method was used.

- **Sources and Techniques Used for Data Collection :** Proposed research work will be made on primary and secondary data. Primary data collected from field survey of wells, tube wells and bore wells. Visit to the agricultural land in study region and measure the actual present water table of wells, tube wells or bore wells and acquired past information with the help of questionnaire. Researcher will prepared questionnaire for getting information about ground water level, cropping pattern, irrigation system, socio-economic status of the farmers. This questionnaire filled by farmers in the study region. About **40 farmers will be selected** as sample for field survey, conducting in command area of the project. For assessment of water level approximately 20 per cent wells, tube wells and duck wells are observed by researcher and getting information about their year wise water level from 1995.

Secondary data collected from Gul Medium project office, Malapur, Govt. Agriculture department, Groundwater Survey Office, Panchayat Samiti and Tahsil Office for getting information about rainfall, temperature, rock structure, reservoir capacity, command area of project, cropping pattern, agriculture production, level of water table etc. Population figures obtained from census handbook.

- **Analysis of the Data :** After the collection of data , process on the data with the help of MS-Excel. Analyzed the data with the help of GPS and Cartographic technique. For analysis of data by various maps of study region, water table, percolation, irrigation, proportion of wells and tube wells, cropping pattern and many components will be prepared by researcher.

Study Region :

Physiographically, the basin area of the Gul river is covered by the Satpuda mountain range and the River Tapi. The average height of the study region having 200 meter from MSL. High altitude occurred on the project site having 240 meter and low altitude occurred at the southern part of the command area. Slope of the study region from north towards south. Gentle slope is for the relief in the study region. Catchment area of the Gul Project having high altitudinal level and acquired the hilly area of Satpuda mountain.

Study region having three seasons like summer, rainy and winter. The maximum annual average temperature is 42.33 °C and minimum is 10.36 °C in the study region. The study region receives moderate rainfall from the southwest monsoon. The average annual rainfall in the study region is 735.00 mm.

According to the Census 2011, total population of the study region was 36820 (11 villages). Out of them 6.4 per cent was belongs to SC and 22.7 per cent was belongs to ST.



Analysis :

Water is vital resource for existence of human being. It play important role in human development. Agricultural, industrial sectors need ample water for large scale of production. So the use of water is increasing day by day. Due to water scarcity, many crises are arises in most part of the country during year2012-13. In peninsular India, all rivers are flowing only in monsoon season, and rest of the year these are dry. Therefore, many serious problems facing population about unavailability of water.Such as drinking water shortage, irrigation for agricultural crops, industrial production and construction. Ground water also consumption by peoples with the help of wells and tube wells hence, the level of ground water also decreases day by day.

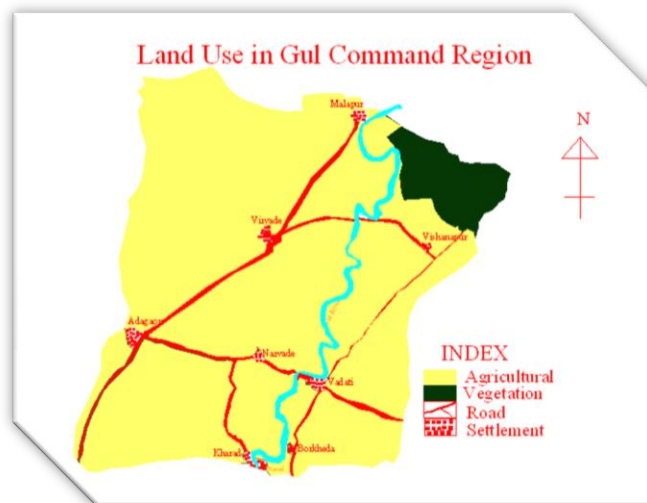
Due to over irrigation and increasing population pressure in the study area. Along with the uncertainly of monsoon is one of the main cause. Hence, ground water level in the command area of the project is decreasing in last decades (1995-2005). Now days, after completion of the

project ground water table increasing in command area of the project. Not only increasing water table but also positive changes in cropping pattern in the area due to Gul project. Living standard of population is changed due to the increasing income of farmers and agricultural laborers in the region. Ultimately the use of water is increased in the region. Therefore, there is need to assess ground water for sustainable development of the area, and to save ample water for future generation.

Agricultural Landuse :-

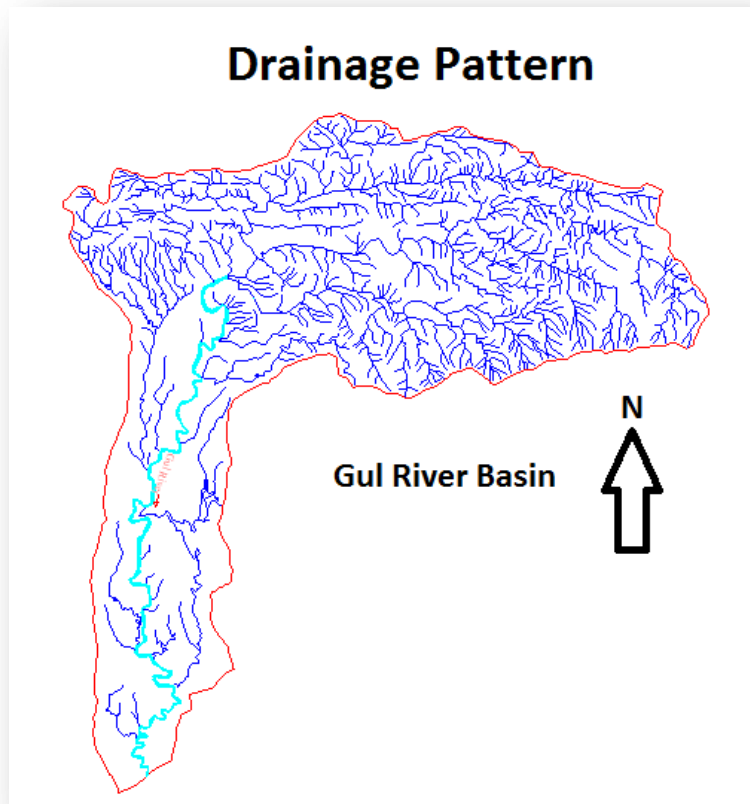
Agriculture is the major and most important occupation of the population in the study region. More than 88 per cent of the population was directly engaged in agricultural practices in the nature of farmers or agricultural laborers. More than 92 per cent of the land is used under the cultivation and agricultural practices. Proportion of the irrigated land to the total land was very rare before the completion of Gul Project in the study region. These proportion was occurred high after the completion of the concerned project due to the availability of groundwater, those percolated by the water storage of the project.

Cotton, Sugarcane, Banana, Corn, Wheat, Onion, Vegetables, pulses and other food grains are the major crops in the study region. Proportion of sowing cash crops was increasing in the study region due to the increasing proportion of agricultural irrigation.



Watershed of Gul River Basin :-

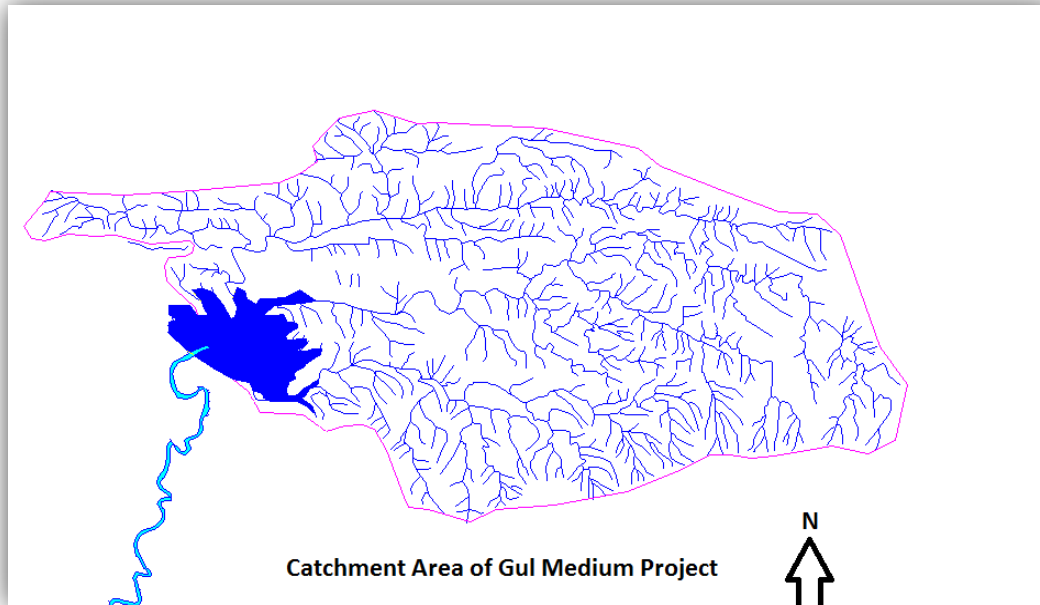
River Gul having one of the most important watershed area in the Chopda tahsil. Gul watershed is the minor sub basin of the Tapi river basin. River Gul flowing from the near village Malapur. Gul river formed by the confluence of three nalas like Tirsingya Nala, Korara Khodara Nala and Debar Nala at the north side of the project dam. Confluence of above three nalas at the foothills of Satpuda mountain near village Malapur. River Gul flowing from north to southward and reaches to the river Tapi at near Kolamba. Total length of the river Gul is about 46 km. Catchment area of the Gul Medium Project lies between Satpuda Mountainous region. Various small streams are flowing in the region with abundant source of water mainly in rainy season. River Gul having various tributaries. Fertile river basin formed by the flood plain of River Tapi and river Gul in the study region. Total watershed area of the river Gul is 236 sq. km.



4.3 Catchment Area of Gul Medium Project :-

Catchment area of the Gul Medium Project is about 115.06 sq. km. Whole area comprising between the Satpuda mountain region. Catchment area of the Gul project is actually

the watershed of Tirsingya Nala, Korara Khodara Nala and Debar Nala. At near Malapur, all three nalas joining to each other and forming a major channel namely river Gul. Various small size channels and streams are flowing in the catchment area of the project. Many streams are flowing in rainy season and other beings perennial.



Command Area of Gul Medium Project :-

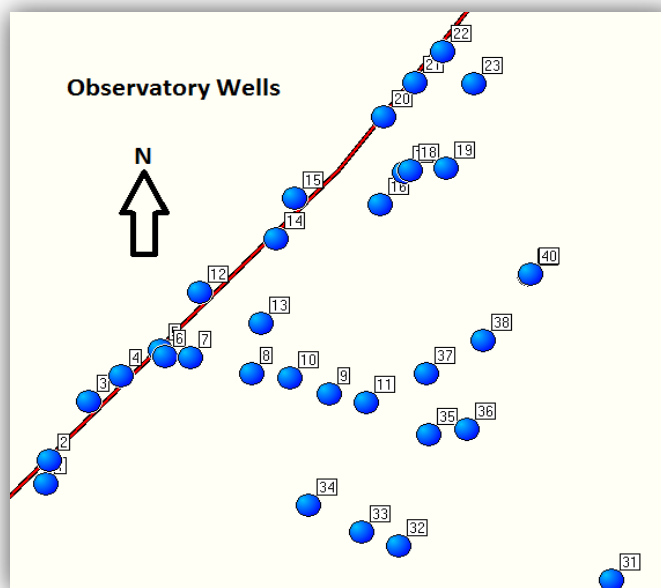
Gul Medium Project sanctioned in year 1984 by Government of Maharashtra. Actual construction of the project was started in year 1991. Completion of the dam site for storage the water in reservoir in year 2008-09.

Gross Command area of the Gul Project is 4164 hectares and total Culturable Command Area is 3708 hectares. Out of them 1168 hectares and 2540 hectares are on the Left bank and Right bank of the river Gul respectively. Total 11 numbers of villages are situated in the command area. Reservoir of the Gul dam is helpful for the percolation of water and get benefits to the groundwater recharge in the command area. Water table is rising in study region due to the percolation of storage water of reservoir.



Table No. 1 : Characteristics of Sample Wells/Tube wells

Characteristics	No. of Wells	No. of Tube Wells	Total
No. of Observations	17	23	40
Observations on - RBC	11	19	30
LBC	06	04	10



Groundwater Status :

Groundwater model study consist of collecting all existing information related to water table at present and past, construction year of wells or tube wells, discharge of groundwater,

capacity of electric pump, irrigation method used for the agricultural crops, cropping pattern, total area of agricultural land and out of them how irrigate by groundwater, importance of the project in the view of availability of groundwater in the study region etc. This was the useful information for the assessment of groundwater in the command area of Gul Medium Project.

Altitudinal Analysis of the Observation Wells :-

Altitude is one of the most important measure for the analysis and assessment of the groundwater trends and their level. Following tables represents the average altitudes of the observation wells and the impact of altitude on water table of groundwater in the study region.

Table No. 2: Altitude of the observation wells

	Altitude of OW	Altitude of OTW	Average Altitude
Right Bank	241.36 mt	207.26 mt	217.76 mt
Left Bank	229.16 mt	213.50 mt	222.90 mt
Average	237.05 mt	205.73 mt	219.05 mt

Source : Computed by Author, 2019

Study region having average altitude from the mean sea level is 212 mt. Research sample having different altitudinal level from sea level. Table shows, the average height of observatory wells on right bank was 241.36 mt and on on left bank was 229.16 mt. Altitudes of observatory wells on right bank having 4.25 mt high than the average altitude of all observation wells in the whole command area. Average altitude of tube wells was 205.73 mt in the study region having lower altitudes than the altitudes of wells. Wells and tube wells having average altitude in the command area was 219.05 mt. the average altitude of wells and tube wells was 237.05 mt and 205.73 mt respectively.

Here clearly shows that the wells are constructed on high altitudinal level, near the project and tube wells are construct at lower altitudinal level and apart from the project site. Average distance of the tube wells construction from project reservoir is 6 km and average distance of the construction of wells from the reservoir is about 2.4 km. hence study clearly mentioned that the impact of Project reservoir on the groundwater table in the command area of the Gul Medium Project.

Depth Analysis of the Observation Wells :-

Depth of the wells and tube wells construction is fully depends upon the water table. Here attempt to analyse the groundwater affects depth of the wells and tube wells in the command area of the project. Following table shows average depth of wells and tube wells in the study region.

Table No. 3: Depth of the observation wells

	Depth of Wells	Depth of Tube wells	Average Depth
Right Bank	19.16 mt	106.62 mt	74.29 mt
Left Bank	14.83 mt	117.50 mt	55.90 mt
Average	17.63 mt	108.17 mt	69.69 mt

Source : Computed by Author, 2019

Table represents the data of average depths of wells and tube wells in the study region. Depth was wells and tube wells occurred different due to the availability of different level of groundwater table. Average depth of wells was 17.63 mt only. And average depth of constructed tube wells was 108.17 mt in the command area of Gul Medium Project.

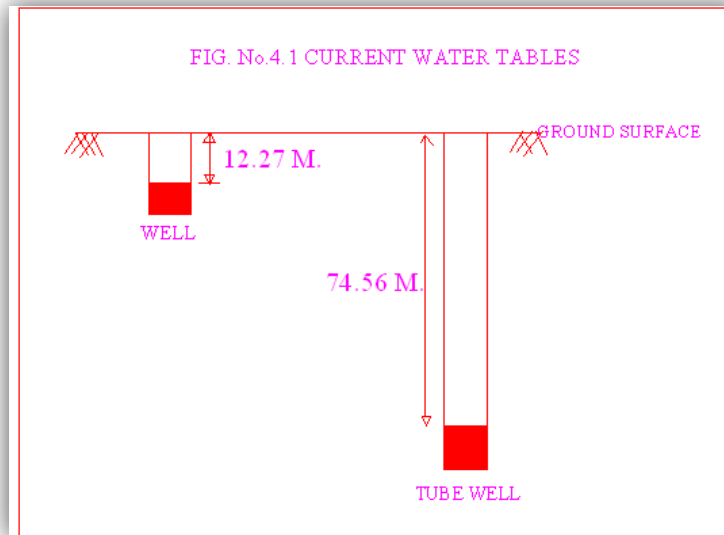
Construction of wells observed at nearest to the project reservoir site and mostly on the near river bank of both sides. Construction of wells from average duration of the construction was higher than the construction of tube wells. Wells was construct from averagely 19 year before the conducting survey. The project started and tube wells are construct mostly after completion of the project reservoir. Because due to the water storage in project and percolation from that is one of the reason.

Current Status of Water Table :-

Table No. 4: Current Water Table

	Water Table in Wells	Water Table in Tube Wells	Average Water Table
Right Bank	12.87 mt	72.63 mt	50.72 mt
Left Bank	11.16 mt	83.75 mt	40.20 mt
Average	12.27 mt	74.56 mt	48.09 mt

Source : Computed by Author, 2019.



Current status of water table is one of the measure of assessment the groundwater. For the assessment of groundwater, here measure current water table below ground level in the period of field work. Averagely current groundwater level in the study area was 48.09 mt below ground level (bgl). Tube wells are construct or formed at southward and long from the project reservoir, hence “water table decreased in that area. Current water table occurred in tube wells was 74.56 mt and in wells was only 12.27 mt bgl. High level difference occurred in water table of that region that was constructed wells or tubewells. This difference was 62.29 mt between the wells and tubewells .

The difference occurred in water table of groundwater between present and on construction of wells was 4.96 mt . Groundwater level decreasing rapidly about 5 mt with in the average period of 12 years. Discharge of groundwater was increasing for irrigation to agricultural crops , hence , rapidly decrease the water table.

Groundwater Assesment Between Pre and Post Monsoon in Watershed Area :

Assessment of groundwater in study region was occurred in different in different seasons. In hot summer, it means in pre monsoon period average depth of the water table was 53.94 mt bgl. And in post monsoon ,water table found on 40.91 mt. bgl. Abot 13 mts difference observed in groundwater table between pre monsoon and post monsoon seasons.

Depth of groundwater in the study region ranges from 8 mt to 14 mt bgl during pre monsoon period .Shallow water levels , between 8 to 10 mt bgl was seen in the near of Gul Project within 4 kms , water table occurred shallow depth of water . Long distance from the project, depth of water table decreasing from the earth surface . Depth of groundwater level in Tube wells was much higher than the depth in wells . About 130 mt bgl water table was observed in pre monsoon period.

Table No. 5: Groundwater Level : Pre and Post Monsoon

Pre Monsoon		Post Monsoon	
GW Level (mt bgl)	No. of Wells or Tube Wells	GW Level (mt bgl)	No. of Wells or Tube Wells
Below 10 mts	01	Below 10 mts	08
10 – 20 mts	16	10 – 20 mts	09
20 – 50 mts	03	20 – 50 mts	07
50 – 100 mts	16	50 – 100 mts	16
Above 100 mts	04	Above 100 mts	00
Total	40	Total	40

Source : Computed by Author, 2019.

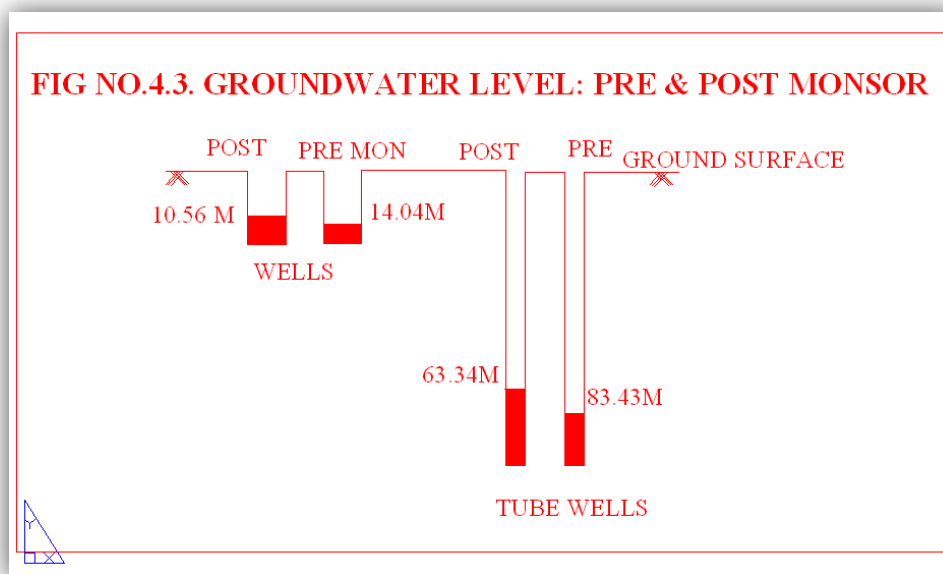


Table shows , all observatory wells was having groundwater level within 20 mts bgl. And all tube wells having water table above 20 mts bgl in pre monsoon seasons.

The depth of water table from earth surface in post monsoon ranges from 6.94 mt into the tube wells. Tube wells having groundwater level for post monsoon season was ranging from 30 mt to 100 mts bgl. The average groundwater level in post monsoon was 40.91 mt bgl. The average groundwater level in post monsoon period for wells in the study region was 10.56 mt bgl. This was 3.52 mt rising from the water level observed in pre monsoon period. About 20 mt water table increased in tube wells between the pre monsoon and post monsoon period in the command area of Gul medium project.

Water table increasing near southern periphery from the project and wells and tube wells, those constructed on river bank of Gul.

Cropped area and Irrigated Area :-

Table No. 6: Agricultural Land Holding and Irrigation

	Average area per OW		Average
	Right Bank	Left Bank	
Irrigated Area	4.08 Acr	3.55 Acr	3.95 Acr
Unirrigated Area	1.25 Acr	0.45 Acr	1.03 Acr
Total Agricultural Area	5.33 Acr	3.90 Acr	4.98 Acr

Source : Computed by Author, 2019.

Average acreage having farmers or owners of land holding for each observatory wells or tube wells was 4.98 acres in the study region. It clearly shows that the mostly farmers belong to the category of minor land holding farmers in the region. Out of them, 3.95 acres land was irrigated through the groundwater available in the farms with the help of wells or tube wells. Many wells and tube wells were constructed in the recent years after the completion of project reservoir. Only averagely 1.03 acres area of the total agricultural land having un-irrigated due to the economical problems and others being applied traditional method of irrigation for the crops.

Cropping Pattern :-

Cropping pattern also reflects the availability of groundwater in any region. More proportion of sowing cash crops is the result of surety of groundwater available in potential zones available in the study region.

Table No. 7: Cropping Pattern

Crop Combination	Name of Bank	Name of Irrigated Crops
6	Right Bank	Cotton, Banana, Sugarcane, Corn, Onion, Others
5	Left Bank	Cotton, Sugarcane, Banana, Corn, Others
7	Command Area	Cotton, Banana, Sugarcane, Corn, Onion, Vegetables, Others

Source : Computed by Author, 2019.

In the study area six and five crop combination found in right bank and left bank respectively. Seven crop combination found in whole command area of the Gul Medium Project. Irrigated Cotton, Banana, Sugarcane, Corn, Onion, Vegetables was the major crop observed in the study region. Five crop combination region was left bank Cotton, Sugarcane, Banana, Corn, Others was the major crops. And in right bank having six crop combination with major crops are Cotton, Banana, Sugarcane, Corn, Onion, Others. That is the reflection of availability of ground water in the study region. So irrigation availability was also more in command area of the studied.

Conclusion :

In the present study groundwater assessment are studied in the command area of Gul Medium Project for the view of policy planning. The study concludes that- the impact of Project reservoir on the groundwater table in the command area of the Gul Medium Project.

Depth was wells and tube wells occurred different due to the availability of different level of groundwater table. Average depth of wells was 17.63 mt only. And average depth of constructed tube wells was 108.17 mt in the study region.

Current status of water table occurred in tube wells was 74.56 mt and in wells was only 12.27 mt bgl. High level difference occurred in water table of that region that was constructed wells or tube wells. This difference was 62.29 mt between the wells and tube wells .

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All observatory wells was having groundwater level within 20 mts bgl. And all tube wells having water table above 20 mts bgl in pre monsoon seasons.

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