GROUNDWATER CRISIS A NATURAL HAZARDS FOR AGRICULTURE: A GEOGRAPHICAL STUDY FOR PAKUR DISTRICT

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Abstract:

Water is most precious natural resource on this Earth. It is an essential part of civilized modern life. It is used in drinking, bathing, washing, irrigation, industrial and a host of other works. Availability of water is both from surface water as well as ground water. In the modern age, the use of water in different purposes has to such an extent that its scarcity has posed a major problem to be faced by the dwellers in the urban and rural areas. The traditional flood irrigation in India as well as Pakur, accounts for huge water loss through unscientific ways and from other ways. This system could be replaced by drip irrigation/spray irrigation, shower irrigation.

Pakur District is situated in Santhal Pargana division of Jharkhand state. It is a part of Rajmahal Highlands. The terrain is undulating made up of hard rocks, mostly granitic and basaltic; the amount of surface water & groundwater is very limited. Therefore the use and demand of water in so many purposes has drawn the attention of Planners, administrators, Scientists to chalk out the strategy and planning for conservation & management of these vital resources.

The crisis of groundwater resource is concerned with the *sustained yield of wells and aquifers, maintaining the balance between discharge and recharge and its quality* for optimum utilization in different sectors of economy. The groundwater is more widely utilized and is easily available than surface water in study area due to better aquifer's characteristics. But rapid growth of population, modernization of agricultural activities, use of chemical fertilizers and HYVs altogether has encouraged the over-exploitation of groundwater resources. Some blocks of the study area have come into the critical category of stage of groundwater development. The main purpose of this research paper is to find out the to assess the groundwater resources of Pakur district which includes the groundwater crisis in reference to hydro-geologic conditions, water level characteristics, estimation of future requirements of groundwater resources through conjunctive use of surface and groundwater.

Keywords: *Essential, Management, Groundwater, Aquifers, Utilization, Hydro-geologic. Resource, Conservation, Management, Groundwater, Hard rock,Terrain , irrigation.*

Introduction

Water is precious natural resource, a basic human need, and is sustaining for life. Water consists 90% bodies of all living or biotic things like human, animal, plants, and birds. Water is necessary for all livelihood activities, without water, impossible to perform these activities. Water is the most crucial not only for all the processes of life but also for all the processes of the ecosystem of the earth. It is the base of the ecological cycle on which it runs. Human being requires water for their continuation. The various world civilizations have also developed around the availability of this valuable water resource. Water occurs on, above and below the surface of the earth in liquid, solid or gaseous form. It occurs in the atmosphere as minute water droplets, ice crystals and vapour on the surface as water of streams, lakes and oceans, and below the surface as soil moisture and groundwater. Although water is almost continuously changing its state and geographic space under a huge system, known as the hydrological cycle. Scarcity of water denotes that the crisis and

conservation techniques used in the district should be overviewed. The management of groundwater resource is discussed with the support of aquifers, wells, other water bodies maintaining the balance between discharge and recharge and its quality for best utilization in different sectors of economy.

Objectives

The main objective of the present Paper is asses the water crisis management and challenges and Initiation of water resource in Pakur District which includes the water availability, scarcity, conservation of groundwater. In this regards the following are the major objectives of the present Paper: To study the geological and physiographical characteristics of the study area influencing the occurrence of groundwater.

- To describe some demographic conditions related to groundwater consumption.
- To assess the groundwater resources of the study area in terms of its present utilization pattern in different sectors of economy..
- To assess the conservation and crisis management for groundwater in the study area.

Methodology

This present paper is based on government offices reports, some primaryobservations, researches conducted by the research scholars, review of related literatures, websites, Published reports and articles by different states, central government, local bodies and NGO's secondary data collected. All data sources have been applied to have a conception of the water conservation and crisis management problem in the study area

Study Area (Pakur District)

The district Pakur,is located between 21^0 58ˈN to 25^0 18ˈ N and 83^0 22ˈ E to 87^0 58ˈE in the north eastern part of the state of Jharkhand, is surrounded by Sahibganj, Dumka, Godda, and state of West Bengal. with geographical area of 1805.59 Sq. km. the district posses as 9.00422 lakh population.

The area and population of district are 2.27% & 2.83% of the state respectively. Almost all major rivers became dry in the district most of year shows the scarcity of water. Groundwater level is continuously decreasing due to over exploitation of water in crop producing area in the district. Because of falling groundwater table, people are making deeper hand pump or boring gradually. While recharging rate of underground water is much lesser than withdrawal of water. Due to cultivation surface soil continue to be used and degraded, Besides the soil degradation and erosion also help to decrease agricultural production.

Geological Formation & Hydrogeology of the Area

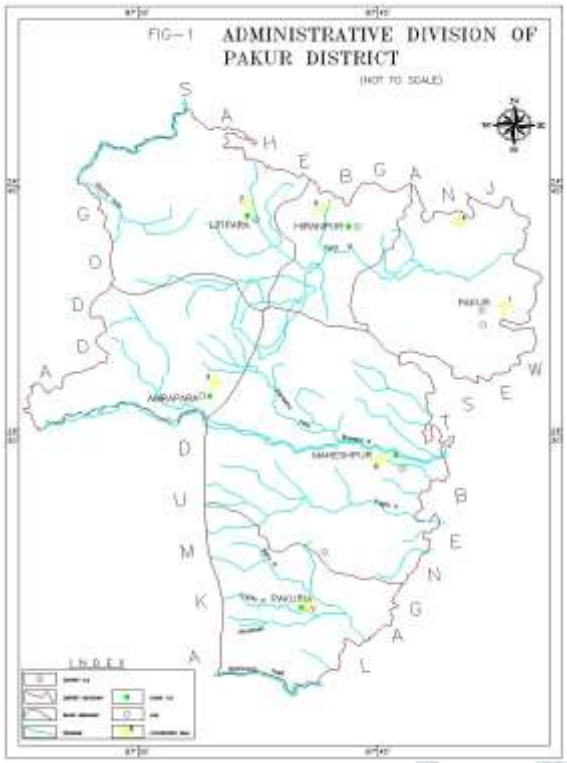
Most part of the distirct is undulating topography like hilly area, enclosed by basaltic flows of Rajmahal trap. And other geological formation of the district laterite, alluvium and gondwana rocks. Eastern part of the district covers alluvium deposit while western part covers Gondwana formation and rest part occurs laterites, and some other geomorphological structure like rolling pan plain having ancient ridges and resistant lava plateau of Rajmahal found in southern part. Pakur is largely covered by forest and small hills; a part of parasnath hills spreads in chhotanagpur plateau and Santhal Pargana. And topographically Pakur is divided into the hilly area, the rolling area and the alluvial area of these three parts. The hilly area is made from North corner of the district up to the Southwest border with the state of West Bengal. In the North and North Eastern part of the district, having a narrow strip of alluvial soil, between the Ganga feeder canal and the loop line of Eastern Railway, is very fertile area.
Atmospheric precipitation. The groundwater is generally not improved by seepage of river water because rivers are discharge in nature. In Pakur district 19 percent of total groundwater and surface water is being utilized for irrigation, industry and domestic uses.

Water Resource

The world's total water resource is predicted as $1.37x10^8$ million hams. Of these total global water resources about 97.20 % is saline water mainly restricted into sea and oceans. Only 2.80 % is accessible as fresh water of which 2.20% is in the form of surface water and 0.60 % as groundwater. Even out of this 2.2 0% of surface water, 2.15 % is fresh water in glaciers and iceberg and only of the order of 0.01 % ($1.36x10^4$ M ha.m.) is available in lakes and reservoirs, and 0.0001 % in steams; the remaining being in other various forms. Out of 0.60 % reserved as groundwater, only about 0.30 % (**Raghunath, 2009**)..

Surface Water

The amount of water in an area above the surface of the earth in the form of rivers, canals, lakes or tributaries is known as surface water. It is lost through evaporation, seepage into the ground where it becomes ground-water, used by plants for transpiration, extracted by mankind for agriculture, living, industry etc. or discharged to the sea where it becomes saline.



Ground Water

Water, which is present below the surface of the earth in aquifer material, is known as ground water. The amount of ground water present in any area directly depends upon the amount of Precipitation annually, type of overlying rocks or sediments, rate of infiltration and rate of discharge in that area.

Thus the haphazard development in different sectors of economy and inefficiency in use of water has led to many problems like flood and water logging, soil salinity and alkalinity, losses of water due to faulty irrigation system, overexploitation of groundwater and surface water and water quality deterioration.

At present river water and groundwater used in agriculture, animalhusbandory, industries, domestic uses, drinking water. For insuffiency the fulfillment of use of river water in these activities, groundwater exploited ore and more. Its result is that groundwater level is declining downward 1 to 1.5 meter per year. For these activities upper sources of groundwater is becoming dry. So the fulfillment of necessity of water, bottom as well as deep and deep sources of groundwater is exploited continuously. This deep water is saline quality contaminated, so the result of these water affecting an ill effect on soil health as well as human health. On the other hand, cost of crops production increasing due to increasing cost of drain out of water from deep sources of groundwater.

So it is a serious matter that how we keep well our agriculture, human and animals health, with keeping reserve to groundwater sources. It is doubtless that 'first food of plant' is water. Hence each drop of water will be use, so '***water year 2007***- '**theme crop per drop'** or '**per drop more crop'** celebrated. It is an indicator for agriculture.

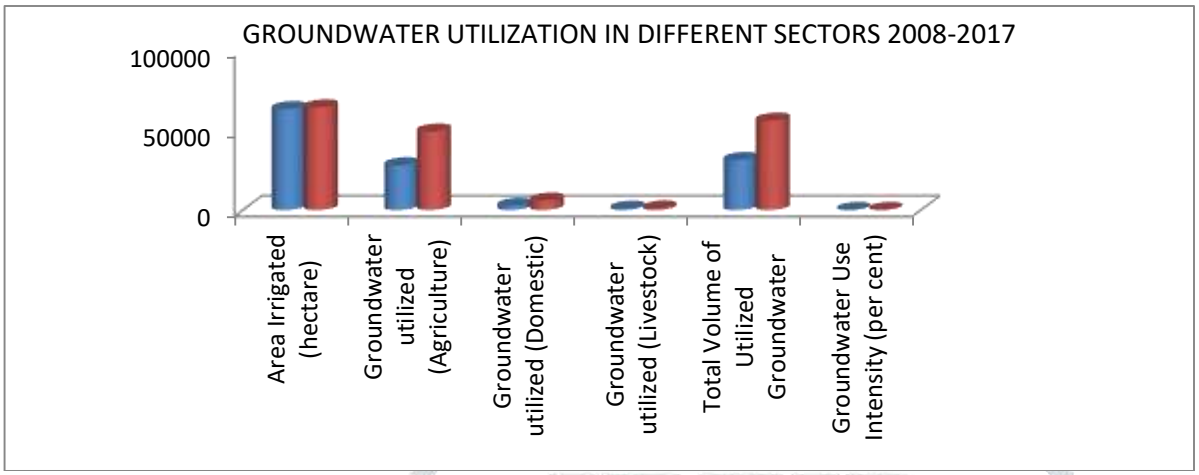
The Net Groundwater availability of the district is 12684.77 ham. The Gross groundwater draft for all uses of the district is 1713.56 ham. The Net groundwater availability for future irrigation development for the district is 10520.82 ham. Domestic water demand is 0.267 ham, Livestock demand is 0.009815 ham., Net water demand for industries in the current year is 0.1260 BCM and total current water requirement is 0.450 BCM. Therefore District Pakur:

Groundwater Utilization in different Sectors 2008-2017

Items	2008-09	2016-17	Percentage change
Area Irrigated (hectare)	63296	64371	4.76
Groundwater utilized (Agriculture)	28008.60	49159.70	56.97
Groundwater utilized (Domestic)	2556.13	5868.16	43.60
Groundwater utilized (Livestock)	791.54	980.69	80.71

Total Volume of Utilized Groundwater	31356.27	56008.55	55.98
Groundwater Use Intensity (per cent)	18.27	32.63	14.36

Pakur Irrigation Report 2016. Pakur statistical handbook 2015.



Water Demand of the District for Various Sectors (Present):

Based on calculation it reflects that total current water requirement is 0.450 BCM.

sector	2015	2020	Existing	gap
Domestic	0.0237	0.0256	0.0213	0.0053
Agriculture	0.1933	0.2884	0.0577	0.2307
livestock	0.0088	0.0098	0.0063	0.0035
Industrial	0.1008	0.1260	0.1008	0.0252
total	**0.3256**	**0.4509**	**0.1861**	**0.2648**

Source: District Census Handbook Pakur, (District Irrigation Plan Pakur 2016

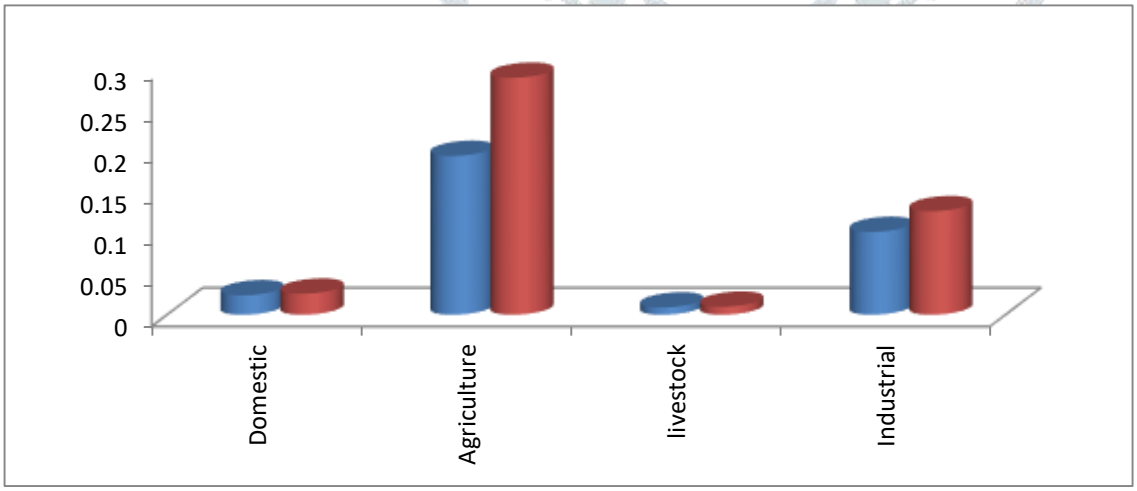


Fig: Water Demand Of The District For Various Sectors

Detail Of Groundwater Resources And Stage Of Ground Water Development In Pakur District As On 31st March 2018 (In Hectare Meters)

S. No	Blocks	Net Annual Ground Water Avaibilty	Gross Groundwater Draft For Irrigation	Gross Ground Water Draft For Domestic And Industrial Water Supply	Gross Ground Water Draft For All Uses (4+5)	Allocation For Domestic & Industrial Requirement Supply Upto Next 25 Years	Net Ground Water Availbility For Future Irrigation Development (3-4-7)	Stage of Ground Water Development (6/3X 100) %	Categorization For Future Gw Developmentt Safe/Critical/ Overexploitation
1	2	3	4	5	6	7	8	9	10
1	Litipara	2390.94	67.64	273.96	341.6	239.77	2083.53	14.285	Safe
	Amrapara	1553.95	56.11	162.62	218.73	143.26	1354.58	14.075%	Safe
3	hiranpur	1157.77	3.76	200.7	204.46	154.27	999.74	17.65 %	Safe
4	Pakur	1465.02	174.17	603.24	777.41	475.87	814.98	53.06 %	Safe
5	Maheshpur	3865.51	221.27	507.6	728.87	530.88	3113.36	18.86 %	Safe
6	pakuria	1660.96	30.12	267.28	297.4	169.51	1461.3	17.90 %	Safe
	total	12095.15	553.07	2015.4	2568.47	1713.56	9827.52	22.63 %	safe

Source: Groundwater information booklet, Pakur District, 2008 and 2013, & Pakur Irrigation Report2016.

Causes for Declining the Groundwater Level in the district:

i. Outbreak of those crops which has more production and less water needed;

Latest variety of crops which are short height and dunkel types crops needed more water for irrigation. In these variety of crops has necessity of more nutrition for more production, which fulfill by chemical fertilizers which needed more and more irrigation. More and more irrigation means exploitation or more use of rivers or canals. Which leads to decline the lowering of groundwater level.

ii. To production of more water needed, cash crops:

In present, people forgot the basic principle of agriculture 'Crop Rotation'. So, farmers cropping the cash crops which needed more irrigation and for only aim of earning more and more economic profit. Like potato, sugarcane, wheat, methi, sarson, etc cropping more production, which needed more irrigation.

iii. To use the flood irrigation method: now-a-days exploitation of groundwater is became easy due to machanisation of agriculture. That is why with the help of tubewell and pumpsets, more and more groundwater drained out in low cost and in taking less time. So farmers use flood irrigation in crops means irrigate crops by suppliying more than needed water to crops. It exploit more water and declining groundwater level.

iv. To donot use organic manures: at present most of the farmers use chemical fertilizers instead of organic manures for crop production. Due to negligency of organic manures percentage of is between available living organic carbon is 0.0% to 0.5% . while it is necessary for healthy soil it bacem 0.8%. the water containing capacity of the soil is decreasing due to decreasing use of the oranic manures and humas. Because humas contains and absorbed more water than its capacity.

v. Donot recharge groundwater : generally the groundwater exploitation gradually increasing since after Green Revolution(1966-67) . Because high yielding crops demand more water than other crops. But groundwater not getting recharge in ratio of its drain. Development of water position in country is 58% according to national reports. It means after draining 100 liter of water it recharges back only 58 litre. So groundwater level declining continuously because do not recharging groundwater.

vi. To declining amount of rainwater every year Climate change is continuously going on due to Global warming. Its result is that rainwater amount gradually decreasing every year. But for Agricultural crops, human, animals, and for Industrial work, use of groundwater continuously increasing every year. Although population, animals. And Industies are increasing in numbers every year, while ratio of rain water recharging is continuously decreasing for groundwater recharging.

vii. To provide free electricity to farmers In our country, farmers have to provide free of cost electricity by governments of some states. Due to this free electricity farmers use water an uncontrolled way, and destroy water by wrong way.

Loses Due to declining of Groundwater Level:

i. Danger to drying the groundwater sources-- if the decreaasing rate 1.0 to 1.5 m/year, of declining the groundwater have been being continue, than the time will not be farther, that all groundwater sources will be completely dry soon. If some groundwater sources will remain rest than water draining from that type of sources will be approximately impossible. In this position there might be a great danger for human.

ii. A possibility to enhance the agro-production cost if groundwater level will be declined than drain out of water will be much costly, that will affect cost of crop production. Resultant may be hike the production cost of wheat, paddy, maize, potato, sugarcane etc. and there will not be sufficient irrigation.

iii. A possibility of highly increase in vegetables cost if groundwater level will be down than vegetable production will not be possible, because much irrigation will be needed for vegetation production., and that type of production will be much costly than the production cost, in this situation vegetables will be much costly.and small farmers will not be able to crop vegetables.

iv. Problem of green fodder for cattles if once groundwater level will declined than green fodder crops will not yield without water, like barsim, rizka, jwar, bazra etc, than green fodder crops will not produce in summer season,

v. Possibility of decreasing of dairy production if green fodder crops production will decrease than automatically dairy production also will be affected in negative sense. Because due to declining of groundwater level, fodder grain and crops will be costlybecause of unavailability of irrigation

facility or costly irrigation facility, and that is not be available for small producer, or for poor people. And then number of cattle also will affect.

Measures to Control the declining of Groundwater

I. To implementation and adaptation of Crop Rotation system a. to adapting the crop rotation concepts. Like to crop the less water needed crops after the more water needed crops.exp? Rice-masoor crops. b . To use the crop requires less fertilizer after the use of crops which needed more fertilizer. Exp. Moong-aloo-kaddu, etc. c. to plant scrub root crops after growing very conductive roots plants, like arahar-pea cycle crops, because this rotation can save water with enhancing the fertility of the soil. and crops production will increase and conservation of soil will be done.

II. To adaptation of Drip irrigation, Shower irrigation, and Bedding method if to adapt small bed method for crops irrigation than it takes less water, less time and more area for irrigation. Use sprinkler irrigation or drip irrigation instead of flood irrigation. This type of irrigation save 40% of water and also irrigate more area of crops, it also check the declining of groundwater level.

III. To increase the amount of organic manures if increase the use plenty of organic manures, like FYM, Compost, NADEP compost, vermicompost, Acetate etc, than it increase the humus in the soil and then capacity of soil to hold water is also increased. Resultant is that soil shall need less amount of water for irrigation and less amount of water will drain out for irrigation. And that will definitely check the declining of groundwater level.

IV. To recharge the groundwater level by Rainwater. A compulsory step should will take for "rainwater harvesting" the country. For checking the declining of groundwater level, groundwater level can recharge by putting rainwater into the rainwater harvesting well, for rainwater harvesting. Rainwater harvesting wells will establish in all village, town, and city on the amount of their rain water. It should be mandatory.

V. To put rainwater harvesting in tanks, puddles, dobha, lakes and other water bodies Rainwater should fill in tanks, puddles, dobhas, lakes and in other water bodies. To water filling capacity will not be decrease so these water bodies should to deepen every year. For follow the concept of "village -water -in –village",("gawn ka pani gawn me") so where there is no water bodies available , than there should be make tanks, puddle, dobhas etc in downward areas of that areas.

VI. implementing and adopting river water linkages the Indian rivers inter-link is a proposed lare scale project that aims to effectively manage water resource in India by a network of reservoirs and canals to enhance irrigation and groundwater recharge , reduce persistent floods and water shortage in other parts of India. It can help the water security for all areas where is water crisis remains.

VII. To doing Plantation in every and each village, city, town, Road side, parks, and on barren land. A plantation is a only a best means to increase the rainfall and reduce the Global warming. So it should be very dense afforestation should done and least amount of bio-fuel should be used for that. It can be help us to fulfill our other needs like wood, industrial needs,(paper industry) , etc, Donot provide free electricity to farmers, take a minimum suitable price for that. It is known that if anything we got free than we misuse it. It's a human nature. In this district electricity is free for tube wells, so here farmers misuse the water for their fields.

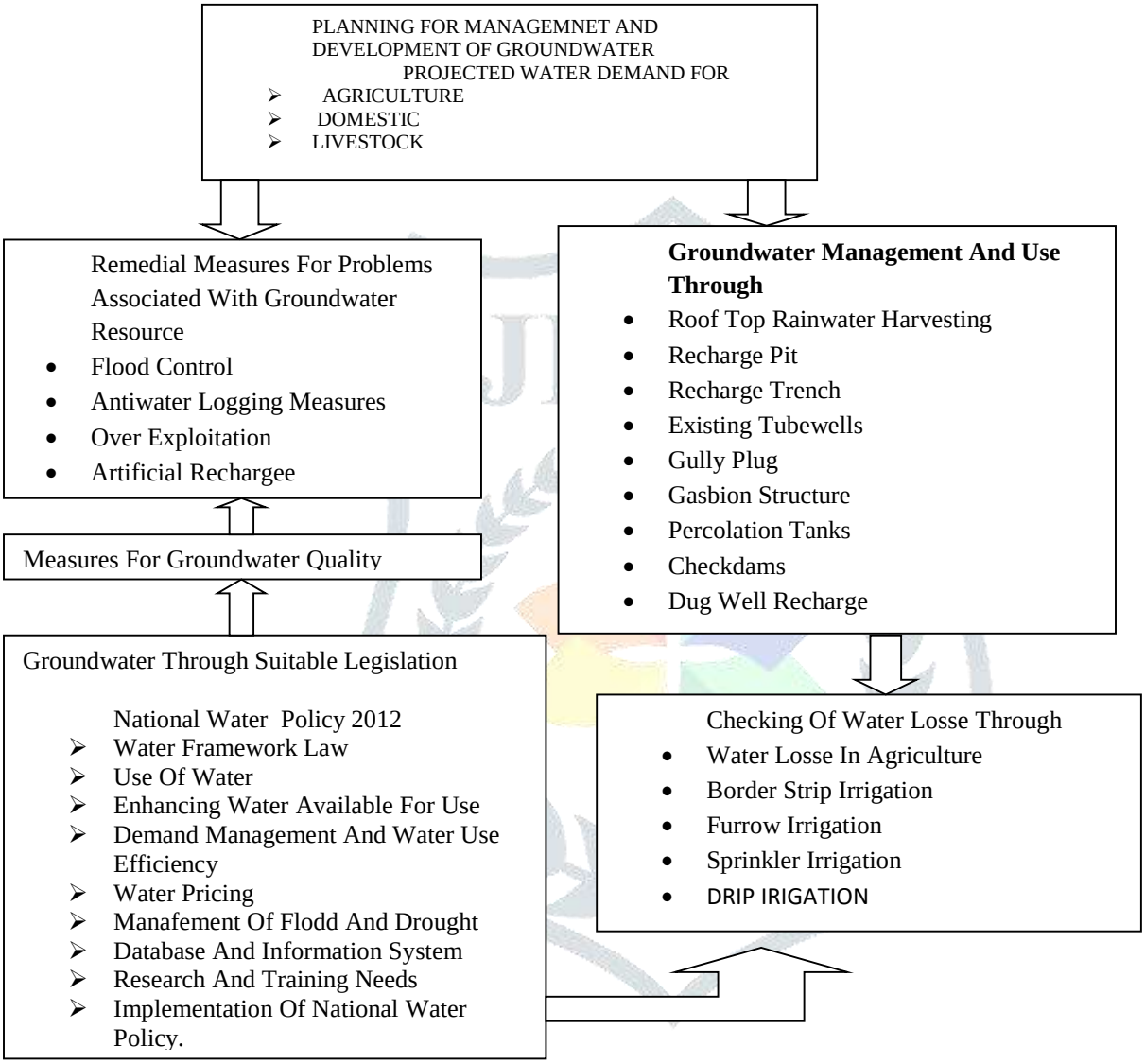
Water Resource Management for check the declining the Groundwater level

The conservation and adequate water resource management is necessary. The management and reuse of irrigational water will adequately help water resource management in the district. To increase the natural supply the recharge is also required in the following style.

Artificial Recharge by River Basin Channel, Trench, Pit Method.

i. Construction of check dams, recharge well in suitable areas.

ii. Rain harvesting techniques should be applied in township and shadow zone.



Recommendations for water resource management in Pakur

- Identification of water scareu area.
- Development of watershed area.
- Study of soil types.
- Recycling of used water
- Assessment of water requirement in industry and agriculture.
- Identification of recharge discharge area.
- Identification of potential aquifer zone.
- Study of secondary porosity in hard rock.

- The sedimentation of major river basin and possibility of disilting should be explored.

Conclusion

It is conclude that in any condition, irrigation water exactly use for only for crops, than country as well as district can get good production of food grains, pulses, oilseeds, fodder crops, vegetables, fruits, flowers,

"Each drop of water is precious", Government is committed to giving high priority to water security. It will complete the long pending irrigation projects on priority and launch the "Pradhan Mantri Krishi Sinchayi Yojna"(PMKSY) with the motto of "har khet ko pani" and "Per Drop, More Crops'. The groundwater is not more widely and easily available than surface water in study area due to bad aquifer zone under the surface. Problems related with groundwater resources crisis have been tried to identify and discuss in present paper with spatial variation of groundwater level and management, along with their characteristics, recharge from surface water; decline and fluctuation of groundwater level due to over-exploitation.

The main objective of the present study is to assess the crisis management of groundwater resources in Pakur District. To put it absolutely Pakur district has a total water demand of 0.45BCM, in the district 0.186 BCM water is already available in existing water bodies. The district needs to create additional water storage of 0.265 BCM. For meeting the requirement district has put a plan to construct mare than 4400 ponds, 5500 davas,345 check dams etc to improve groundwater recharge. The plan also has been prepared to promote drip irrigation and sprinkler irrigation using water saving measures like mulching to reduce wastage of agricultural byproducts and improve the water use efficiency. Sector wise water gap is biggest for agriculture followed by industry. Other sectors like live stock require 0.003 BCM, domestic domestic water demand stands at 0.005 BCM. Here is an assumption that domestic water requirement will grow at 20% keeping in mind the decadal population growth.

REFERENCES:

Water year 2007(theme crop per drop)
Micro Irrigation Sheme- 2005(w.e f. Dec, 2005) centrally Sponsored.
National River Linkage Proggrame- 2002(launched by Ex-PM- Atal Bihari Bajpayi in 2002
Flood management report
Sprinkler & Drip Irrigation water.
Major Raving Medium/Minor Irrigation Schemes for Expansion of Irrigation Facilities.
National Project on Organic farming w.e.f Cot.2004.
S. H. A. Khan, "Hydrogeology & ground water resources development potential of Ranchi, Lohardaga and Gumla District," Bihar (C. G. W. B. Report), 1987.
GoI (2012), National Water Policy 2012, Ministry of Water Resources.
Rai V.K. (2000). Water Resource Problem, Prospects and Management, Ganga-Ghaghara Doab, Publication House, Varanasi.
Chandana, R.C. (2002). Geography of Population Concept, Determinants and Patterns. Kalyani Publication. New Delhi (5th Edition).
District survey report of mionr Minerals, Pakur.prepared in accordance with para 7(iii) by Ministry of Environment, Forest and Climate Change Notification

Ground Water Yearbook Jharkhand 2015-16 by Government of India, Ministry of Water Resources, Rd&GR Central Ground Water Board-2015-16
A Review of Groundwater Quality Issue in Jharkhand Due to Fluoride, by Neeta Kumari and Gopal Pathak ISSN;2248-9622 Vol.4, March 2014.
Ground Water Information Booklet, Pakur District , Jharkhand State 2008
District Irrigation Plan- Pakur 2016
Ground Water Information Booklet, Pakur District , Jharkhand State 2013