Report of Site Visit to Water Recharge Experiment in GCF, Jabalpur

By -

Dr. C.V. Dharma Rao

Coordinator of Environmental Geosciences in the 36th IGC in India

Joint Secretary and DDG, National Mission for Clean Ganga and Adviser,

National Water Mission Ministry of Water Resources, River Development and Ganga Rejuvenation,

II Floor, Block 3, CGO Complex, Lodhi Road

Mobile: +91-851000138 / +91-11-24366614

E-mail - Dharma.rao@nic.in, venchasa@gmail.com

INTRODUCTION

Ground water is the most preferred resource to meet various requirements and is the Nation's principal reserve of fresh water. However, increased demand for fresh and potable water has resulted in an unprecedented withdrawal of ground water resulting in lowering of the water table as also deterioration in ground water quality at some places. The drying up of a large number of dug wells/ bore wells in some areas due to declining ground water levels have a direct impact on water supply for irrigation, industrial and domestic needs in Madhya Pradesh. Demands for safe drinking water and requirements to maintain healthy eco-systems are increasing and complex social and scientific questions have arisen as to how to assess and manage ground water resources. In view of this, MOWR felt it is absolutely necessary to find innovative methods and initiate some measures which will not only re-charge ground water but also prevent it from getting contaminated.

This site visit to Water Recharge Experiment in GCF, Jabalpur and its report has two objectives which may be carried out in phases.

1. To suggest some practically tried out measures that will help re-charge of ground water aquifers in a very fast and cost efficient manner.

(a) Recharge through deep bore wells of 6-8 inch diameter perforated pipes made at all points where water gets accumulated or flowing like ponds, rivers, lakes.

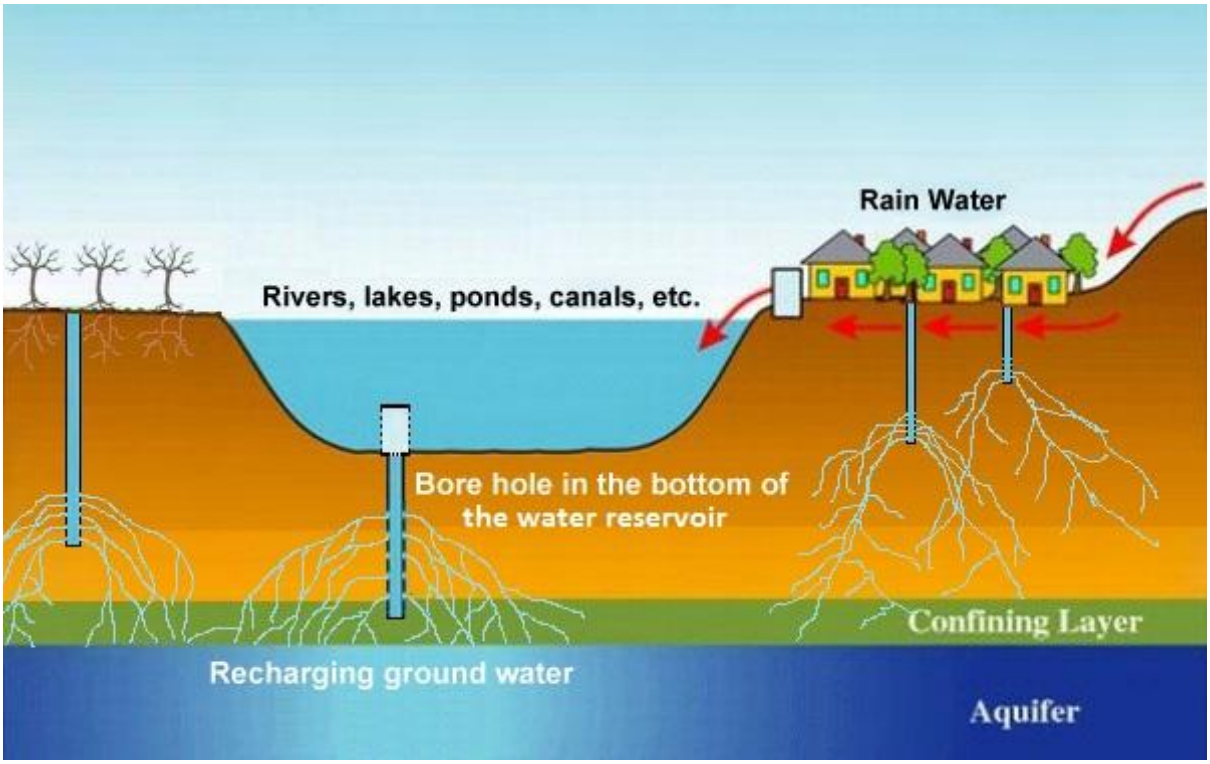
(b) Collection of rain water through inverted umbrella type structures installed at various places roof tops, boundary walls etc./and specially designed / developed water parks (several water canopies installed at a place and water collected is passed through a centrifugal separator before being guided to underground for recharge) – This concept, however, could not be seen at GCF, Jabalpur.

2. To suggest measures that will prevent ground water contamination

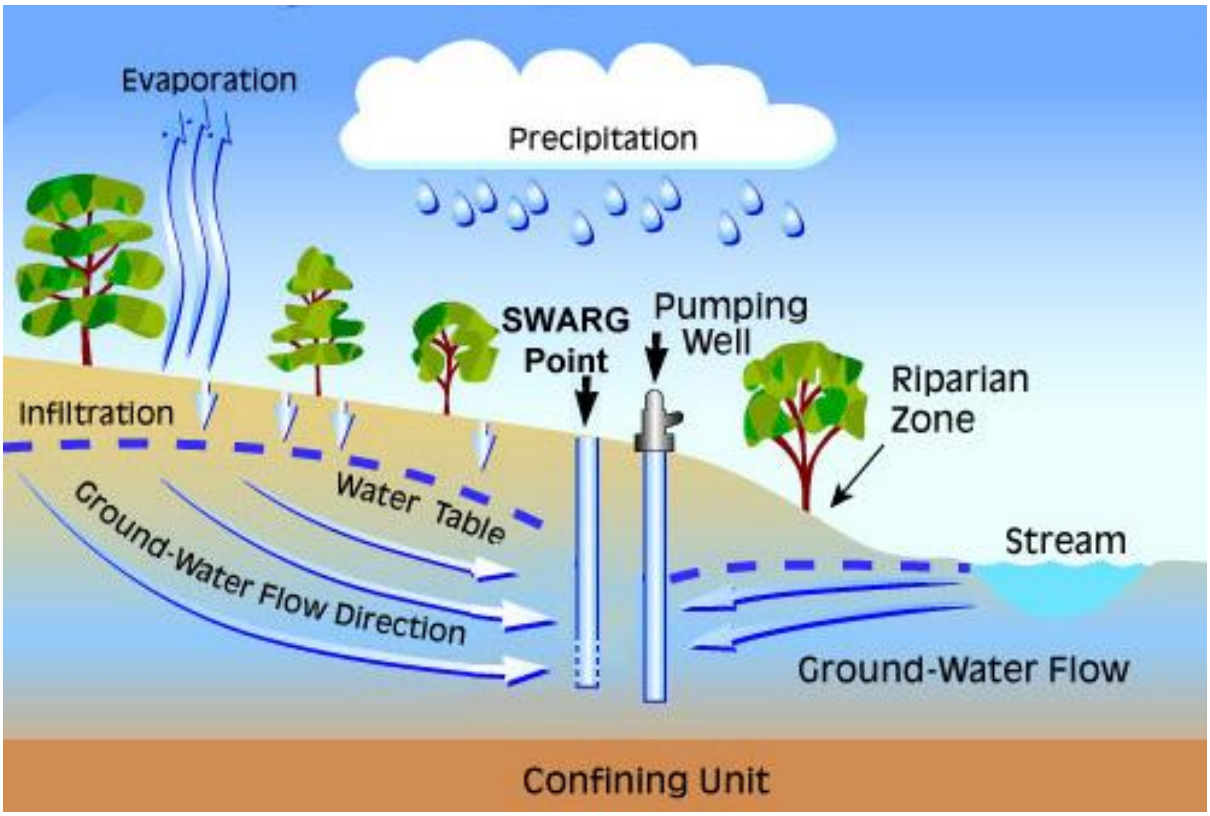
(a) Installation of bio digesters in place of septic tanks leech pits and various other waste to compost equipments near the water recharge points - To be carried out in later phase.

The above mentioned methods of ground water are schematically represented below:

SWARG – SUPER WATER ACCELERATED RECHARGE IN GROUND




WATER PARK
(Roof Tops/ Open Spaces/ Boundary Walls/ Parks)
RAIN WATER STORAGE
CENTRIFUGAL WATER SEPARATOR
www.su-rajfoundation.com
Mob. No.: +91-9810172353
AQUIFER


Evaporation
Precipitation
SWARG Point
Pumping Well
Riparian Zone
Infiltration
Water Table
Ground-Water Flow Direction
Stream
Ground-Water Flow
Confining Unit

BRIEF BACKGROUND

M/S Su-Raj Foundation (www.su-rajfoundation.com) headed by its founder president Mr. Sanjay K. Aggarwal is an NGO based at New Delhi. This NGO has some of the experts as its trustees and is active in this field of water and environment protection since the last two years. The NGO has been experimenting on its own through various measures to solve the underground water crises problem of the country. M/S Su-Raj Foundation has also made presentations to the Governments of Himachal Pradesh and Madhya Pradesh on the subject where also they have received good acceptance of their approach and methodology. One such experiment was conducted at Gun Carriage factory under Ministry of Defence, Government of India, Jabalpur. MOWR taking cognizance of the efforts of M/S Su-Raj Foundation in developing an innovative Water Recharge Experiment in GCF, Jabalpur has undertaken this site visit to study and report the observations of this experiment and submit its recommendations.

The following is the list of officers who were present at GCF, Jabalpur as a part of the team to make observation and make recommendations-

1. Dr. C. V. Dharma Rao – Advisor – National water Mission – MOWR – GOI, New Delhi
2. Mr. S. K. Singh – Sr. GM - GCF, Jabalpur - Ministry of Defence - Government of India
3. Mr. Kapil Chaudhary – JT GM – GCF, Jabalpur - Ministry of Defence – Government of India
4. Dr. H. S. Namdev – Scientist `D' – Central Ground Water Board - Bhopal
5. Mr. B. P. Sigh - Scientist `D' – Central Ground Water Board
6. Mr. Sanjay K. Aggarwal – Founder President Su–Raj Foundation, Delhi
7. Mr. Hari Singh Gaur, CE - PHED – Government of Madhya Pradesh – Zone, Jabalpur

8. Mr. Subodh Jain, SE – PHED – Government of M.P., Jabalpur Zone

9. Mr. Mukesh Srivastava, EE- PHED Government of M.P., Jabalpur Zone

10. Mr. Sharad Gupta, AE - PHED – Government of M.P.

PRESENTATAION BY GCF, JABALPUR team

Team of GCF comprising Mr. S. K. Singh, Sr. GM, Mr. Kapil Chaudhary, JT GM made presentation to the team as mentioned above and apprised of their whole approach and the technique applied. The salient points of the presentation are:

1- GCF factory has an area of around 158 acres. Factory has rain water canal of around 900 meters in which rain water gets collected and was discharged outside the factory with no visible advantage.

2- On year back factory took an initiative in the field of Rain water recharge to underground, Vermi compost making and solar plant of 11 MW.

3- In the rain water drain, 5 nos. bore wells of 6 inch dia were made in a pit of size 4x2 depth 2 metre and up to the depth of 6 metre form the bottom of the drain and filled with filter media. A check dam/ Vessel valve was also provided. Re-charge performance was monitored. The re-charge result was very encouraging. Through this system for shallow aquifer re-charge was done to the first shallow aquifer which was available. It was observed that water was getting recharged at the rate of 10,000 litres / hour approx. through a single bore well.

4- Encouraged by the re-charge output and to further improve the recharge process, ten nos. re-charge bore wells of diameter 8 inches along with a recharge pit filled with filter media each at spacing of 80-90 metres were dug up to the depth of 25-30 metres so as to re-charge the aquifer present at that particular depth along with provision of check dam / Baffle wall at downstream of each bore well. One pit has one bore well only.

5- GCF while presenting the details showed confidence that several environmental benefits will also be noticed soon in a period of 1-2 years

because these re-charge benefits mainly the ground water table improvement.

Boreholes at the site used for underground water re-charge

OBSERVATIONS AT JABALPUR (GUN CARRIAGE FACTORY – UNDER MINISTRY OF DEFENSE – GOVT. OF INDIA) by different teams

COMMENTS by Public Health Engineering Department (PHED) - GOVT. OF BHOPAL TEAM

The experimental site was visited by the team of PHED, Central Ground water Board team officers of GCF along with Sr. GM and Su-Raj Foundation Founder President. Two sites within GCF factory where ground water recharging is successfully taking place were visited by the PHED team of experts. Their comments are summarized below:

1. It is a good experiment as well as a very successful effort on ground water re-charge. CGWB observed that depth of bore well should be based on the geological conditions of the ground. Average bore well shaft should be taken up to the point from where aquifer starts. PHED team has also corroborated the statement given by CGWB team. PHED confirmed that GCF team have implemented the same.

2. Initially GCF team made bore well up to 6 metre depth to re-charge the shallow aquifer and later on re-charged the aquifer which is available at the depth of 25 metres and 30 metres. To this extent, PHED team strongly acclaimed the efforts of the GCF team and the Su–Raj foundation.

3. Through a single re-charge bore well approximately GCF is re-charging rain water to the extent of 10000 litres / hour.

4. The team observed that there has been notable improvement in ground water table and water is also now available easily and close to the ground.

5. PHED team recommends that provision of re-charging narrow diameter bore wells is a very successful experiment and if implemented at a larger scale across the country will definitely improve ground water reserves.

6. The team felt that all defunct dried bore wells made to take out water should be converted into recharge wells.

   (a) By making the re-charge pit around the dried bore well of 2-3 metre diameter and filling it with gravel. Depth should be around 3 metre filled with filter media of gravels boulders and sands.

(b) By providing inverted umbrella type FRP structures around the dried defunct bore well and connecting all those canopies through a pipe and centrifugal solid water separator. This will ensure the purest form of re-charge to the ground. Canopies will be very effective and good in case of rooftop harvesting, domestic harvesting. The team also appreciated the concept of Water Park.

(c) PHED also recommends that all houses should have ground water harvesting with a mandatory re-charge bore well shaft also made in harvesting ground. Without a recharge shaft, rain water harvesting will never be successful.

(d) If there are some roof tops available around the dried bore well hand pump, then rain water should be harvested on the roof top and connected to the dried bore well there by converting it in to a recharge bore well.

(e) Rain water harvesting is only a rule applicable in urban area. It should be applicable in rural area also as a lot of construction is taken place in rural areas also.

COMMENTS BY THE OFFICERS OF CGWB – CENTERAL GROUND WATER BORAD (CGWB), Bhopal

1- The officers of Central Ground Water Board have accepted and recommended the approach of making deep and shall narrow diameter bore wells fully. They also affirmed that they have experimented this approach at many places in Madhya Pradesh already and found useful results. The comments of CGWB are as below:

2- It is recommended that for re-charging the shallow aquifer re-charge shaft using a Hume pipe (with average 2-3 metre diameter filled with bolder at bottom, followed by pebbles, gravels and coarse sand at the top) may be constructed. Such a re-charge aquifer is also called phreatic un-confined aquifer. Top of the Hume pipe may be kept 0.5 metre above the base level of the bottom of the pond / tank level, this will also level some water always accumulated in the pond to let people meet their local needs.

3-The CGWB team further suggested that to recharge the deeper aquifer (semi-confined / confined aquifer) recharge through well can be constructed. The depth of the recharge tube well should be decided based on depth at which the aquifer is present which has to be recharged. It may vary from area to area and formation to formation.

4-Though the above is very ideal for faster re-charge no of 6-8 inch diameter with many deep recharge holed bore wells with perforated slotted pipes against the aquifer should be made to further augment the recharge process. The soil of Yamuna river basin is alluvium in nature in which normal recharge takes place but it is slow. therefore deep bore well of 6-8 inches will help very fast recharge of Yamuna water deep in to aquifers. The team also recommended that where ever possible in all river basin including Yamuna and Ganga, ponds, canals, 6-8 inch diameter perforated pipes can be used for easy water recharge.

5-For community acceptance and to avoid nuisance form anybody falling in to borehole and for better surface area for the percolation of water, the team recommended that many 6-8 inches deep bore wells will be better in small pilot projects rather than a Hume pipe larger 2-3 meter bore wells which can be used in big projects.

6-All these bore wells in alluvial formation will be constructed using rotary rigs and these bore well will be constructed using blank / slotted pipes and shrouded with gravel of proper size to avoid collapsing of the loose formation.

7-However, in hard rock areas, the recharge tube wells may be constructed using DTS rigs in which gravel pack will not be required.

8-The depth of the recharge well should be decided based on local hydro geological condition and presence of aquifer at different depths. In case of multi aquifer systems (they are not interconnected) recharge deep tube wells should be constructed of variable depths to recharge aquifer existing at different levels.

9-In case of hard rock area, the phreatic (unconfined aquifer) the re-charge can be done by adopting recharge shaft or construction of percolation tanks.

10-Citing the specific example of Bhopal, the team suggested that the catchment area of KALISOR , ULJHAVAN , KERVA dams can have many deeply small diameter bore wells before the advent of rains to take advantage of recharging during rains.

11.In Bundelkhand region of Madhya Pradesh where granite formation is there and which is very hard and compact in nature for water to percolate, the recharge can take place only where the granite is weathered and fractured in nature. It is suggested that large no of existing tanks in this terrain should immediately be renovated, by provisioning of recharge bore wells up to 30-40 meter . This will ensure the recharging of ground water even in such difficult terrains.

12-In hilly states like HP and Uttarakhand , Sikkim , where ever the water accumulation is there or a water source is originating , deep bore wells should be provided . Spring water coming from mountains should be collected and guided to go underground through deep bore wells. Fitment of a centrifugal solid separator form water at the opening of the bore wells is recommended which will prevent ant trash polythene going in to underground.

13-All home water harvesting pits should also have a minim 6 inch diameter bore well which will guide the rain water to go deep underground . This approach has also been suggested by M/S Su Raj Foundation. Rain water harvesting if tried through inverted umbrella type structure as suggested by M/S Su-Raj Foundation will be very effective and ensure better collection and ground water re-charge.

The CGWB team expressed their overall satisfaction with the efforts and initiatives of GCF factory in the field of ground water recharge . They recommended that experiment that it is worth replicating such an experiment all over the country.

RECOMENDATIONS

- ✓ After taking all technical factors into consideration during the site inspection, the visiting team recommends that provision of deep and shallow bore well is very cost effective and one of the innovative ways to solve ground water depletion observed in several parts of the country

- ✓ Over all based on the study and the feedback from all the experts from CGWB, PHED and ordnance Factory team the experiment seen in the visited site showed good potential for replication in other areas. All the experts have appreciated the concept, approach and methodology of the experiment conducted by Su- raj foundation and its trustees and therefore recommend to recharge Ground water and prevention of contamination of Ground water by making recharge 6-8 inches bore wells

- ✓ Work carried out by CGWB team under national aquifer mapping have already recommended to construct recharge shaft in the existing tanks available in Bundelkhand region of Madhya Pradesh(Distt Tikam Garh Chattarpur Sagar), there are already 963 ancient tanks constructed during chandella dynasty having huge water storage capacity existing which should be provided by Recharge shafts for faster ground water recharge and to full capacity. As the terrain in Bundelkhand is mostly granitic terrain where natural water percolation does not take place, the team recommended Hume pipe for recharge.

- ✓ PHED team informed that they has also experimented the bore well recharge shaft in Tikam Garh district last year which gave wonder full results in recharging the well and many hand pumps were recharged. PHED team recommends that as the efforts of GCF and Su-Raj foundation are commendable and they may be given an opportunity to intensify their efforts and recharge the ground water in all the 24 blocks which are presently over exploited and in critical category. These 24 blocks have around 5000 defunct dried hand pumps which need to be recharged and another 5000 recharge bore wells need to be made. Among this around 2000 feasible defunct bore wells, some bore wells can be made functional The cost of each bore well is estimated to be around 20000/= each.

- ✓ The team finally recommended that a few pilot projects may be taken based on this simple technique in a few places along the alluvial gangetic plains and along the river Yamuna and in the Bundelkhand region. These pilot projects may be immediately taken up and completed during ensuing monsoon season. The pilot projects can be under taken by either by CGWB or National Water Mission and implemented by any state agency like PHED. An Independent agency may be identified to assess the efficacy of the pilot projects.

Ministry of Water Resources, National Water Mission, Central Ground Water Board, PHED, Govt. of M.P., Ordinance Ministry of Defence and Su-Raj Foundation Team concluding the findings of the visit of Project – SWARG. Member and Senior GM of Ordinance factories discussing with Adviser, NWM.

Visiting Team lead by Dr. C.V. Dharma Rao, Adviser - National Water Mission at the site of SWARG installation in Jabalpur.