



जलसंसाधन, नदीविकास एवं गंगा संरक्षण मंत्रालय
भारत सरकार

MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

GOVERNMENT OF INDIA

Interim Report

Project wise Impact Assessment of Completed Demonstrative Artificial Recharge Projects of XIth plan



CHECK DAM AT SATAON BLOCK, DISTRICT RAEBARELI, UP

CENTRAL GROUND WATER BOARD
NEW DELHI
SEPTEMBER, 2016

Interim Report
**Project wise Impact Assessment of Completed Demonstrative
Artificial Recharge Projects of XIth plan**

Prepared & Compiled under the Technical Guidance of

K B Biswas, Chairman
Central Ground Water Board
&
Dr E Sampath Kumar, Member
Central Ground Water Board

Contributors

Dalel Singh, Superintending Hydrologist, CGWB, New Delhi
S. K. Juneja, Scientist-D, CGWB, New Delhi
P. Yadaiah, Assistant Hydrogeologist, CGWB, New Delhi

CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES RIVER DEVELOPMENT & GANGA REJUVENATION
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CONTENTS

<i>ITEM</i>	<i>Page No</i>
NEED FOR ARTIFICIAL RECHARGE	1
PLANNING OF ARTIFICIAL RECHARGE PROJECTS	1
ARTIFICIAL RECHARGE TECHNIQUES AND DESIGN	2
DEMONSTRATIVE RAIN WATER HARVESTING & ARTIFICIAL RECHARGE PROJECTS DURING VARIOUS FIVE YEAR PLANS BY CGWB	6
SOME OF THE COMMON RECHARGE TECHNIQUES IMPLEMENTED	8
IMPACT ASSESSMENT REPORTS	
Andhra Pradesh	9-12
Chhattisgarh	13-22
Delhi	23
Gujarat	24-28
Jammu & Kashmir	29-32
Jharkhand	33-35
Karnataka	36-56
Kerala	57-83
Maharashtra	84-91
Nagaland	92-95
Odisha	96-129
Rajasthan	130-141
Tamil Nadu	142-153
Telangana	154-159
Uttar Pradesh	160-161
West Bengal	162-164

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NEED FOR ARTIFICIAL RECHARGE

Natural replenishment of ground water reservoir is slow and is unable to keep pace with the excessive continued exploitation of ground water resources in various parts of the country. This has resulted in declining ground water levels and depleted ground water resources in large areas of the country. In order to augment the natural supply of ground water, artificial recharge to ground water has become an important and frontal management strategy. The efforts are basically augmentation of natural movement of surface water into ground water reservoir through suitable civil structures. The techniques of artificial aquifer recharge interrelate and integrate the source water to ground water reservoir and are dependent on the hydrogeological situation of the area.

The rainfall occurrence in the country is monsoon dependent and in large part of the country rain fall is limited to about three months period ranging from around 20 to 30 days. The natural recharge to ground water reservoir is restricted to this period only. The artificial recharge techniques aim at increasing the recharge period in the post-monsoon season for about 3 more months providing additional recharge. This results in providing sustainability to ground water development during the lean season. There is thus a need to prepare a systematic implementation plan for augmenting ground water resources under various hydrogeological situations. However specific emphasis needs to be given in the areas where ground water levels are declining and water scarcity is being experienced. In this report emphasis has been given to the areas with declining trend and deep ground water levels.

PLANNING OF ARTIFICIAL RECHARGE PROJECTS

Basic requirement of artificial recharge

- Availability of non-committed runoff in space and time
- Identification of suitable hydrogeological environment and sites for augmenting subsurface reservoir through cost effective artificial recharge techniques.

The remaining criteria and inputs required for planning the scheme are:

A) Identification of Area

- Areas where ground water levels are declining on regular basis.
- Areas where substantial amount of aquifer has already been desaturated.
- Areas where availability of ground water is inadequate in lean months.
- Areas where salinity ingress is taking place.
- Urban Area where decline in water level is observed.

B) Hydrometeorological studies

- Rainfall pattern in the area.
- Evaporation losses from the area.
- Climatological features that effect the planning of artificial recharge.

C) Hydrological studies

- Insitu precipitation on the watershed.
- Surface (canal) supplies from large reservoirs located within basin
- Surface supplies through trans basin water transfer.

- Treated municipal and industrial wastewaters.
- Hydrological investigations are to be carried out in the Watershed/Sub-basin/basin for determining the source water availability

D) Soil infiltration studies

- Control the rate of infiltration
- Prerequisite study in cases of artificial recharge through water spreading methods
- Infiltration rates can be estimated by soils infiltration tests using Cylinder or flood infiltration meters instruments.

E) Hydrogeological studies

- Is the prime importance study
- First step is to synthesize all the available data on hydrogeology from different agencies.
- Study of satellite imagery for identification of geomorphic units.
- Regional Hydrogeological maps indicating hydrogeological units, both at shallow and deeper levels.
- Water table contours to determine the form of the water table and the hydraulic connection of ground water with rivers, canals etc.
- Depths to the water table (DTW) for the periods of the maximum, minimum and mean annual position of water table.
- Ground water potential of different hydrogeological units and the level of ground water development.
- Chemical quality of ground water in different aquifers.

F) Aquifer Geometry:

- Data on the sub-surface hydrogeological units, their thickness and depth of occurrence
- Disposition and hydraulic properties of unconfined, semi-confined and confined aquifers in the area

G) Chemical Quality of Source Water

- Quality of raw waters available for recharge is determine
- Treatment before being used for recharge
- Relation to the changes in the soil structure and the biological phenomena which take place when infiltration begins
- Changes expected to the environmental conditions.

ARTIFICIAL RECHARGE TECHNIQUES AND DESIGN

A variety of methods have been developed to recharge ground water. Artificial recharge techniques can be broadly categorized into:

a. Direct surface techniques

- Flooding
- Basins or percolation tanks
- Stream augmentation
- Ditch and furrow system
- Over irrigation

b. Direct sub surface techniques

- Injection wells or recharge wells
- Recharge pits and shafts

- Dug well recharge
- Bore hole recharge
- Natural openings, cavity fillings.

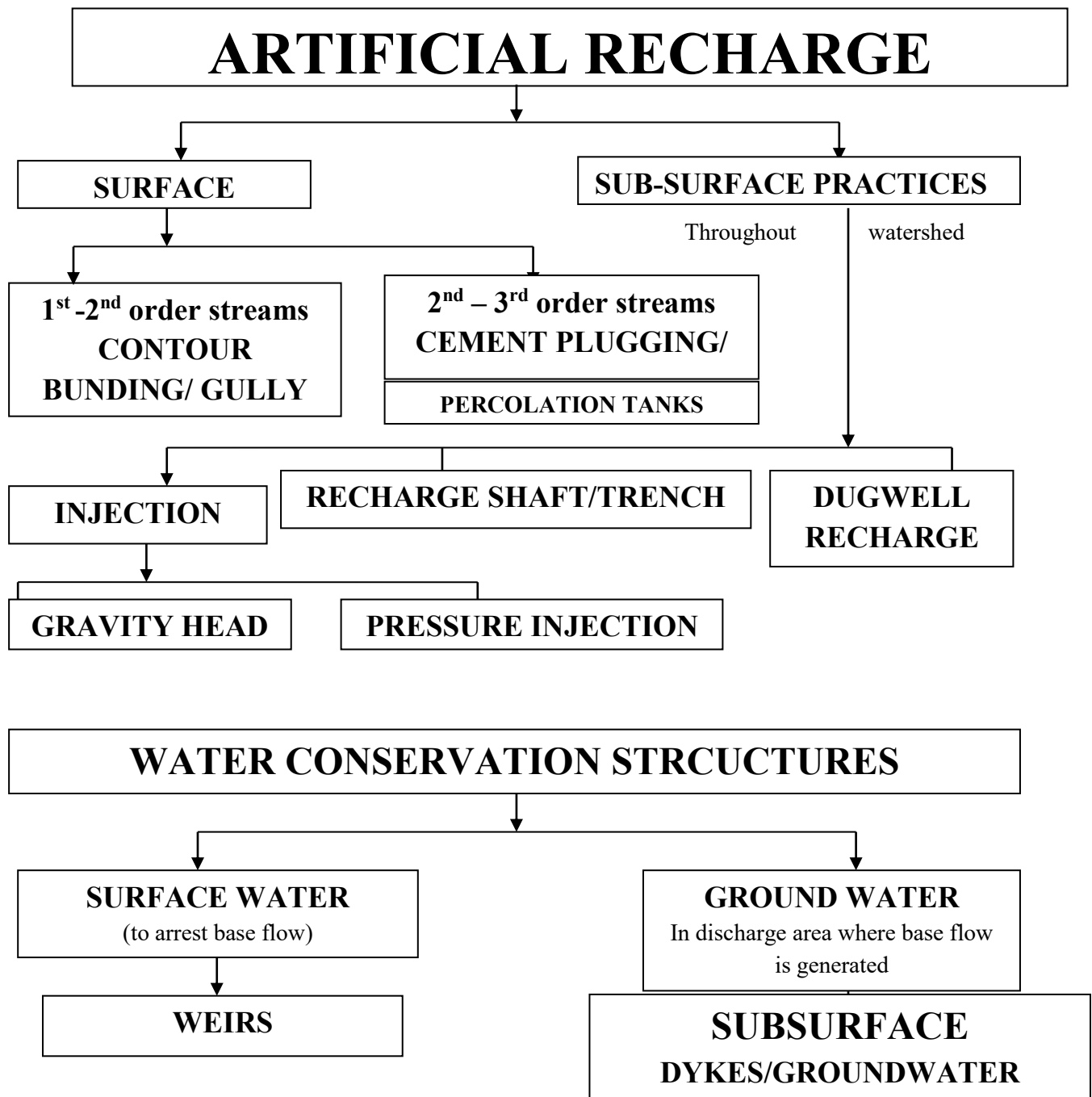
c. Combination surface – sub-surface techniques

- Basin or percolation tanks with pit shaft or wells.

d. Indirect Techniques

- Induced recharge from surface water source.
- Aquifer modification

Although no two projects are identical, most use variation or combination of direct method, direct-sub-surface, or indirect techniques. A schematic diagram of the artificial recharge methods used is given as flowchart below.



Ditch and Furrow Method: In areas with irregular topography, shallow, flat bottomed and closely spaced ditches or furrows provide maximum water contact area for recharge water from source stream or canal. This technique requires less soil preparation than the recharge basins and is less sensitive to silting. Generally three patterns of ditch and furrow system are adopted.

Lateral Ditch Pattern: The water from stream is diverted to the feeder canal/ditch from which smaller ditches are made at right angles. The rate of flow of water from the feeder canal to these ditches is controlled by gate valves. The furrow depth is kept according to the topography and also with the aim that maximum wetted surface is available along with maintenance of uniform velocity. The excess water is routed to the main stream through a return canal along with residual silt.

Dendritic Pattern: The water from stream can be diverted from the main canal to a series of smaller ditches spread in a dendritic pattern. The bifurcation of ditches continues until practically all the water is infiltrated in the ground.

Contour Pattern: The ditches are excavated following the ground surface contour of the area. When the ditch comes closer to the stream a switch back is made and thus the ditch is made to meander back and forth to traverse the spread are repeatedly. At the lowest point down stream, the ditch joins the main stream, thus returning the excess water to it.

Spreading Basin or Percolation Tanks: Recharge basins are either excavated or enclosed by leaves. In alluvial areas, multiple recharge basins are generally constructed parallel to streams for recharging purposes. Percolation tanks surface water storage constructed over a permeable land area so that runoff is made to percolate and recharge the groundwater storage.

Gully Plug/Check Dam/Nala Bund/Gabbion Structures: Gully plugs are small runoff conservation structures built across small gullies and streams conserve runoff and enhance recharge locally during rainy season. The sites for gully plugs are chosen wherever there is a local break in slope to permit accumulation of adequate water behind the plugs. Check dams/ plugs, small bunds or weirs are also constructed across selected nala sections to impede the flow of surface water in the stream channel for allowing longer period of recharge through channel bed. Nala bunds and check dams are constructed across first or second order streams in areas having gentler slopes. To harness the maximum runoff in the stream, series of check dams are constructed. Gabbion is low height structure, commonly constructed across small stream flow with practically no submergence beyond stream course. The boulders locally available are stored in a steel wire mesh and put across the stream channel as a small dam by anchoring it to the stream side. The excess water overflows these structures storing some water to serve as source for recharge.

Dug Well Recharge: In alluvial as well as hard rock areas, there are thousands of dug wells which have either gone dry or the water levels have declined considerably. These dug wells can be used as structures to recharge. Ordinary dug wells/ bore wells and tube wells can be used as recharge wells, whenever surplus water is available. In such cases recharge takes place by gravity flow. In areas where water levels are declining due to over development, using available abstraction structures for recharging aquifers is the immediately available option. In areas of heavy groundwater exploitation, the dug wells and shallow bore wells often get partially or fully dried up during summer. The formation exposed in these wells is permeable and the unsaturated horizon of phreatic aquifer can be good repository of water if recharged with surplus available water. These wells can be used for pumping as well as for recharging process.

Recharge Shafts/pits/trenches: It is the most efficient and cost effective structures to recharge the aquifer directly. In the areas where source of water is available either for some time or perennially e.g. base flow, springs etc. the recharge shaft can be constructed. Recharge shafts are constructed in the situation when phreatic aquifers are not hydraulically in connection with the surface water. Generally on a regional scale impermeable layers or lenses form barrier between the surface water and water table, and thus the water spreading methods show low efficiency in recharge. For effective recharge of the aquifers, the less permeable zones are required to be penetrated so that the aquifer zones can receive

recharge. The recharge shafts can be constructed in two different ways viz. vertical and lateral. Vertical recharge shafts can be further improvised with or without injection well. Recharge pits overcome the difficulty of artificial recharge of phreatic aquifer from surface water sources. Recharge pit is excavated sufficiently deep to penetrate less permeable strata. Recharge trench is a special case of recharge pit, in which sometimes bore wells are drilled to increase its recharge capabilities. In case aquifers are located below the land surface and overlain by poorly permeable strata, a recharge shaft similar to a recharge pit but much smaller in cross section is constructed.

Artificial Recharge through Injection Well

Injection well is a recharge well similar to tube well but made with the purpose of augmenting the ground water storage of a confined aquifer by pumping-in treated surface water under pressure. Injection well is generally opted when land is scarce, as in urban areas. The aquifer to be replenished is generally over-exploited. In certain hydrogeological setting, the aquifers do not get natural replenishment from the natural recharge because of the confining layers of lower permeability and need direct injection of water through recharge well. Artificial recharge of aquifers by injection recharge wells is also suitable for coastal regions to arrest the ingress of sea water and also to combat the problems of land subsidence in areas where confined aquifers are heavily pumped. Water for recharging is to be properly treated for removal of suspended material, chemical stabilization and bacterial control. Chlorination of recharge water can also be done to prevent development of bacterial growth. The injection well is to be periodically redeveloped for efficient running.

Induced Recharge from Surface Water Sources

It is an indirect method of initiating recharge by pumping from aquifer hydraulically connected with surface water to induce recharge to ground water reservoir. When the cone of depression intercepts river recharge boundary, a hydraulic connection gets established with surface source which starts providing part of the pumpage yield. For obtaining very large water supplies from river bed / lake bed or waterlogged areas, collector wells are constructed. Such wells have been installed in river beds at Delhi, Gujarat, Tamil Nadu and Orissa. In areas where the phreatic aquifers adjacent to the river are of limited thickness, horizontal wells are more appropriate than vertical wells. Collector well with horizontal laterals and infiltration galleries get more induced recharge from the stream.

Subsurface Dykes/ Underground Bandharas

Subsurface dyke is a subsurface barrier across a stream which retards the natural subsurface / ground water flow of the system and stores water below ground surface to meet the demand during the period of need. The main purpose of ground water dam is to arrest the flow of ground water out of the sub-basin and increase the storage within the aquifer.

Roof Top Rainwater Harvesting and Aquifer Recharge

In urban areas where open land is not commonly available, roof top rain water can be conserved and used for recharge of ground water. This approach requires connecting the outlet pipe from roof top to divert the rain water to either existing wells / tube wells / bore wells or specially designed recharge trench / recharge shaft cum bore well. Drain pipes, roof surfaces and storage tanks should be constructed of chemically inert materials such as plastics, aluminum, galvanized iron or fiber glass, in order to avoid contaminating the rainwater. The impact of recharge through these structures to ground water regime is local, but if implemented on a massive scale, it can raise the water level remarkably and increase the sustainability of water supply through shallow depth ground water structures.

DEMONSTRATIVE RAIN WATER HARVESTING & ARTIFICIAL RECHARGE PROJECTS DURING VARIOUS FIVE YEAR PLANS BY CGWB

To protect and augment ground water resources, CGWB has implemented demonstrative rain water harvesting & artificial recharge projects during various five year plans. During VIII plan (1992-1997), 14 rainwater harvesting and recharge to ground water projects were implemented in 9 states. Under the scheme of “**Rain Water Harvesting and Artificial Recharge to Ground Water**”, a total of 62 artificial recharge structures like percolation tanks, recharge shafts, recharge wells, watershed treatment, check dams, subsurface dyke and roof water harvesting were constructed at the total cost of Rs. 3.23 crore. The implementation of these schemes resulted in annual recharge of 4.0 MCM of ground water.

During IX Plan, a Central Sector Scheme on “**Study of Recharge to Ground Water**” was implemented by the Board, under which 165 recharge projects were taken up for implementation in 25 States/UTs. Under these projects, 679 structures were constructed at a cost of Rs. 33.31 crore. Priority was accorded to water scarcity areas having surplus monsoon runoff and sufficient sub-surface storage space and coastal areas affected by seawater ingress. Recharge structures like percolation tanks, check dams, recharge wells, recharge shafts/pits, sub-surface dykes and tidal regulator were constructed under this scheme in addition to roof top rain water harvesting structures. The implementation of these schemes resulted in annual recharge of 45.0 MCM of ground water.

During X Plan, demonstrative projects on “**Rain Water Harvesting and Artificial Recharge to Ground Water**” were implemented under the Scheme of “**Ground Water Survey, Investigation and Exploration**”. The projects were initiated in the year 2006, and continued upto 2008. These projects were implemented in 8 identified areas in the States of Andhra Pradesh, Karnataka, Madhya Pradesh and Tamil Nadu at an estimated cost of Rs. 5.6 crore, under which 197 structures were constructed. Under this scheme, priority was given to hard rock areas having over-exploited ground water resources. The implementation of these schemes resulted in annual recharge of 2.14 MCM of ground water.

During the XI Plan, demonstrative artificial recharge projects were taken up under Central Sector Scheme “**Ground Water Management & Regulation**” in priority areas viz. over-exploited & critical assessment units, urban areas showing steep decline in ground water levels, drought prone and water scarcity areas, coastal areas, sub-mountainous/ hilly areas and areas affected by problem of ground water quality deterioration. Overall 133 demonstrative recharge projects costing Rs. 99.87 crore were approved for construction of 1661 artificial recharge structures in the 22 states/UT i.e. Andhra Pradesh, Arunachal Pradesh, Bihar, Chandigarh, Chhattisgarh, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and West Bengal. The anticipated annual recharge is about 55.20 MCM. A sum of Rs. 92.70 crore was released to State implementing agencies for completion of civil works of recharge structures under the approved demonstrative recharge projects.

It is also to mention that following Seventeen AR Projects with an approved cost of Rs. 317.128 lakhs & 78 no. of AR structures have been dropped due to different reasons mentioned against them:-

- One Project in Kerala (Approved cost Rs. 41.6 lakhs & one AR structure) as the Implementing agency has expressed its inability to execute the Scheme. Funds were not released to IA.
- Fifteen AR Projects in Rajasthan (Thirteen Project with Approved Cost Rs. 78.825 lakhs & 13 no. AR structures) as the Implementing agency has returned the first installment funds released for thirteen projects (Rs. 47.7142 lakhs) expressing their inability to execute the Schemes. In other two projects (Approved Cost Rs. 17.25 lakhs & 2 no. AR structures) IA has been requested

to refund the funds released as first instalment amounting to Rs. 9.66 lakhs as these projects have been implemented by IA themselves from their own funds.

- One Project in Punjab (Approved cost Rs. 179.453 lakhs & 62 no. AR structures) has been dropped as there was no progress in three years after releasing the first installment and IA has returned the funds (Rs. 53.836 lakhs).
- In addition to this 57 structures have been dropped due to different reasons (2 in Andhra Pradesh, 16 in Gujarat, 27 in Kerala, 9 in Punjab, 2 in Telangana & 1 in West Bengal)
- Thus a total of 135 AR structures have been dropped, the revised target is now 1526 against the original target of 1661.

Table : Details of cost, number of approved and completed structures in XI Plan

S. No.	State	Approved cost (Rs in lakh)	Amount released (Rs in lakh)	Number of structures approved	No of structures Completed as on 31.08.2016
1	Andhra Pradesh	130.020	130.020	29	27
2	Arunachal Pradesh	493.11	493.11	80	80
3	Bihar	96.01	96.01	11	9
4	Chhattisgarh	268.80	258.85	34	54
5	Chandigarh	776.03	774.52	54	34
6	Delhi	43.44	43.44	10	10
7	Gujarat	316.24	286.65	116	100
8	Himachal Pradesh	250.017	250.017	20	15
9	Jammu & Kashmir	143.47	136.70	5	5
10	Jharkhand	191.35	205.96*	69	69
11	Karnataka	588.093	588.09	192	192
12	Kerala	94.14	81.65	91	63
13	Madhya Pradesh	860.91	732.88	51	43
14	Maharashtra	15.15	15.15	49	49
15	Nagaland	224.14	224.14	64	64
16	Odisha	464.36	464.36	66	66
17	Punjab	260.33	110.46	86	15
18	Rajasthan	404.777	342.76	52	22
19	Tamil Nadu	526.35	526.35	273	273
20	Telangana	443.39	443.39	90	88
21	Uttar Pradesh	3286.23	2954.11	189	153
22	West Bengal	111.09	111.09	30	29
Total		9987.447	9269.707	1661	1460

* It is also to mention that an additional amount Rs.14.61 lakhs has been sanctioned & released as payment of the service tax @ 4.2 %, Contract Workers Cess @ 1% and Work Contingencies @ 3% in respect of Scheme of Artificial Recharge & Rain Water Harvesting Structures within the Compounds of Indian School of Mines, Dhanbad, Jharkhand State

This interim report comprises of the Impact Assessment Studies carried out before & after the implementation of the 46 completed Artificial Recharge Projects. This report also includes photographs of some of the artificial recharge structures.

SOME OF THE COMMON RECHARGE TECHNIQUES IMPLEMENTED BY CGWB

Flooding

A pilot project was implemented at Chetua to Jamuna, Pandua block, Hoogly district in West Bengal by the Central Ground Water Board in IX plan.

Recharge Basin or Percolation Tanks

Percolation tanks have been constructed by CGWB at Watershed TE-11 Jalgaon district, Maharashtra, at Chirakulam in Kottayam district, Kerala, Sikheri village and Tumar watershed in Mandsaur & Dewas districts Madhya Pradesh, Narasipuram in Alandurai watershed, Thondamuthur and Vedapatti village in Virudhunagar district of Tamil Nadu and in Mahboobnagar district, Andhra Pradesh in central sector scheme. Recharging of aquifers through percolation tanks in above projects has shown encouraging results during impact assessment studies.

Gully Plug / Check Dam/ Nala Bund / Gabbion Structures

The Board has implemented artificial recharge projects by constructing such structures through state government agencies at Ayandikadavu, Chirayanki district, Kerala; Kadam nala, Pusaronala, Brahmaninala and Tepranala in Dumka district, Jharkhand; Gwalpahari, district Gurgaon, Haryana; Thano reserved forest area, Doiwala block, Uttarakhand; Chalokhar in Hamirpur district, Bhatti nala, Suhalnala and Nakerkhad in Kangra district of Himachal Pradesh; Dewal in Kathua district, J&K; Parolnaggal & Chottibarinaggal of district Ropar in Punjab; Bangalore university campus in Karnataka. Substantial impact on augmentation of ground water has been noticed in areas around these structures.

Recharge Wells/Dug Well Recharge /Borehole Flooding

A project of roof top rain water harvesting through dug well recharge at Kavikulguru Institute of Technology and Science (KITS), Ramtek, Nagpur district, Maharashtra has been implemented. An area of 20 hectare had been benefited by storing 8000 cubic meters of water annually in addition to existing resources through this pilot scheme.

Recharge Pits/ Trench and Shafts

The recharge structures like lateral shafts with injection wells have been constructed on experimental basis at Deoli Ahir, in link channel of Hasanpur distributary in Mahendergarh district, Panipat district and near Markanda river in Shahbad block of Kurukshetra district in Haryana State as pilot recharge projects. Similarly Recharge pits with recharge shafts have been constructed at Lodi garden, New Delhi, at Choe no. 1 Bhakhara main line canal village Dhanetha, Samana block, Patiala and on Dhuri drain in Sangrur district, at low dam in village Majra, Tehsil Kharar in Ropar district in Punjab State. Recharge trenches with bore wells have been constructed in Midjilmandal in Mehboobnagar district in Andhra Pradesh and in Taliparamba taluk, Kannur in Kerala. Impact analysis of such projects indicated favorable recharging results.

Subsurface Dykes/ Underground Bandharas

Subsurface dyke is a subsurface barrier across a stream which retards the natural subsurface / ground water flow of the system and stores water below ground surface to meet the demand during the period of need. Central Ground Water Board has constructed subsurface dykes in Ayilam in Trivandrum district, Kerala, Kasrawad, district Kargone, Madhya Pradesh, Saltora block, Bankura district, West Bengal, Nallanpillai Petral village, Villupuram, Tamil Nadu, at Walmi Farm, Madhya Pradesh and Karnataka state.

Roof Top Rainwater Harvesting and Aquifer Recharge

In urban areas where open land is not commonly available, roof top rain water can be conserved and used for recharge of ground water. Urban housing complexes, historical forts and institutional buildings generally have large roof area and can be utilised for harvesting roof top rainwater to recharge the depleted aquifers. More than 50 roof top rain water harvesting and recharge projects have been implemented by the Central Ground Water Board at Assam, Delhi, Chandigarh, several building in Punjab, Jaipur and Udiapur in Rajasthan, Kangra in Himachal Pradesh, Ahmedabad in Gujarat, Kannur

in Kerala, Patna in Bihar, Lucknow in Uttar Pradesh, Dewas and Musakhedi in Madhya Pradesh and Gurgaon and Faridabad in Haryana State.

Andhra Pradesh

No. of AR Projects Implemented : 1

Name of the scheme	Artificial Recharge Structures on ground water in Chittoor District, Andhra Pradesh
Implementing Agency	Irrigation Dept, Govt of Andhra Pradesh
Block/Mandal/Taluk	Vedurukuppam, Karvetinagam, S R Puram, Nagri, Palasundram, Vijaypuram & Madanpallemandal.
Category of block/mandal/taluk	Safe/safe/OverExploited/Safe/Critical/Semicritical/Semicritical
District	Chittoor
Approved Cost (in lakh)	130.02
Fund Utilised	110.255
Type & No. of Structures	29 (Check dams-28, Percolation tanks-1)
Structures completed	27 (Check dams-26, Percolation tanks-1)
Piezometers	27
Type & No. of Structures dropped	2 Check dams were dropped as these were constructed by some other agency.
Impact of the scheme	<i>A perusal of data on water level monitoring and well inventory reveals that the piezometric heads in most of the wells in the vicinity of artificial recharge structures have stabilized and magnitude of fall is reduced to a considerable level though the general long term water level trend is falling during pre- project period. Due to the impact of artificial recharge structures on ground water regime and rise of water levels are anticipated after normal monsoon rainfall. As the aquifer suffered due to high stress conditions, immediate results are not seen even though the aquifers possess good permeability characteristics. Immediate impact, rise of water levels, has been observed at Karvetinagam, Kollakadriga (Karvetinagam Mandal); E Settinatham and Pathapalem (SR Puram mandal) and Santhabylu in Vedurukuppam mandals. The most conspicuous feature is the gradual building up of ground water levels/piezometric heads in the zone of influence of artificial recharge structures. An additional irrigated area of 18.5 hectare paddy and 25.4 hectares non-Paddy in Kharif and 23.8 hectares of Non-paddy in rabi has increased due to construction of Artificial recharge structures. The yield of wells have increased from 2500-8500 lph & 1666-8000 lph in monsoon and non-monsoon during post-project period respectively. Similarly the number of pumping hours also have increased marginally and sustainability of wells for pumping during non-monsoon period has also improved</i>



Check Dam at Karvetinagaram Village



**Check Dam at Kothapallimitta Village
Artificial Recharge Structures on ground water in Chittoor District, Andhra Pradesh**



Check Dam at Mittoor Village Artificial Recharge Structures on ground water in Chittoor District, Andhra Pradesh



Percolation Tank at Pathapalem Village, Artificial Recharge Structures on ground water in Chittoor District, Andhra Pradesh

Chhattisgarh

No. of AR Projects Implemented : 2

No. of AR Projects Impact Assessment Received : 2

Name of the scheme	Ground Water Recharge in SanaudNala, Mili Water Shed, Block Gurur district Durg
Implementing Agency	Water Resources Division, Govt of Chhattisgarh
Block/Mandal/Taluk	Gurur
Category of block/mandal/taluk	Over Exploited
District	Durg
Approved Cost (in lakh)	167.27
Fund released (in lakh)	161.93 (Sanction was revised by the State Government)
Type & No. of Structures	6 (Check Dam with Silt Trap)
Structures completed	6 (Check Dam with Silt Trap)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>A total of 9 observation dug wells were established in Gurur block to monitor the change in water levels. The water level data of these selected dug wells indicate improvement in ground water conditions in the Gurur block (108.7531 sq km) after implementation of the scheme.</i> <i>Enquiries with the local residents/ farmers/ panchayat etc from 12 villages in the Gurur block were done one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures, which have revealed that the construction of artificial recharge in the watershed has improved the sustainability of tube wells in agricultural fields in few villages despite of less rainfall in the block. There is increase in vegetative cover in the watershed due to growth of natural vegetation under better soil moisture availability. The vegetative cover over the watershed is expected to improve over the years, resulting in reduced soil erosion and better percolation of rain water into the sub-surface. Greenery is mainly observed around the structures constructed.</i> <i>The implementation of demonstrative artificial recharge scheme in Milli Water Shed of SanaudNala in Gurur Block of Balod District has been found to be</i>

	<i>effective in conserving the monsoon runoff and in replenishing the ground water resources to some extent in some areas. But the less rainfall in study areas compared to previous year shows that the structures would have worked far better if there would have sufficient rainfall, and the benefits are expected to become clearer within next few more years.</i>
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Check Dam at village Kanwar



**Surface run off arrested at Check Dam, Kanwar
Ground Water Recharge in SanaudNala, Mili Water Shed, Block Gurur district Durg**



Recharge Shaft no. 1 at village Kanwar

Ground Water Recharge in SanaudNala, Mili Water Shed, Block Gurur district Durg





**Before and after photographs of Check dam at Devkot village no. 1
Ground Water Recharge in SanaudNala, Mili Water Shed, Block Gurur district Durg**



**Before and after photographs of Check Dam at Devkot village no. 2
Ground Water Recharge in SanaudNala, Mili Water Shed, Block Gurur district Durg**

Name of the scheme	Artificial Recharge to Ground Water in PatilahNala, Water Shed, Block Bilha district Bilaspur
Implementing Agency	Water Resources Division, Govt of Chhattisgarh
Block/Mandal/Taluk	Bilha
Category of block/mandal/taluk	Semi- Critical
District	Bilaspur
Approved Cost (in lakh)	101.53
Fund Utilised (in lakh)	96.92
Type & No. of Structures	28 (Boulder Check Dam – 18, Check Dam with Silt Trap -10)
Structures completed	28 (Boulder Check Dam – 18, Check Dam with Silt Trap -10)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>A total of 11 no. of observation dug wells were established / selected in the project area to monitor the changes in water levels. The water level data of these selected dug wells indicate theimprovement in water levels in the Bilha block (65.45 sq km) after implementation of the scheme.</i> <i>Enquiries with the local residents/ farmers/ panchayat etc. from 13 villages in Bilha Block were done after one year of implementation of the scheme. The improvement in the performance of ground water abstraction structures have revealed that construction of artificial recharge structure in the watershed has improved the ground water conditions of both dug wells and bore wells in few villages of study area.</i> <i>Improvements in terms of yields of Tube wells and pumping hours have been reported in five villages.</i> <i>There is increase in vegetative cover in the watershed due to growth of natural vegetation under better soil moisture availability. The vegetative cover over the watershed is expected to improve over the years, resulting in reduced soil erosion and better percolation of rain water into the sub-surface. Greenery is mainly observed around the structures constructed.</i>



Percolation tank at Bohardih



Boulder Check dam at Podi

Artificial Recharge to Ground Water in PatilahNala, Water Shed, Block Bilha district Bilaspur



Check dam at Hathni



Boulder Check dam at Hathani

Artificial Recharge to Ground Water in PatilahNala, Water Shed, Block Bilha district Bilaspur



Recharge Shaft at Hathani



Boulder Checkin village Bitkuli

Artificial Recharge to Ground Water in PatilahNala, Water Shed, Block Bilha district Bilaspur

Delhi

No. of AR Projects Implemented : 1

Name of the scheme	Artificial Recharge to Groundwater in the Office, Mess and adjacent area in & around CE Office, WAC, Palam, Delhi
Implementing Agency	Military Engineering Service, Govt of India
Block/Mandal/Taluk	South West
Category of block/mandal/taluk	Safe
District	South West
Approved Cost (in lakh)	43.44
Fund Utilised (in lakh)	43.44
Type & No. of Structures	10 (Recharge Trench with Twin Recharge Wells)
Structures completed	10
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The observation wells at Kabul line, Kirby Place and Shekhawati Line have shown sharp decline in ground water levels in pre-monsoon during 2005-2010. These wells show reduced rate of decline in ground water levels at Kabul Line (pre-implementation decline @ 1.12 m/yr, post-implementation decline @ 0.22 m/yr), Kirby Place (pre-implementation decline @ 1.33 m/yr, post-implementation decline @ 0.68 m/yr) and Shekhawati Line (pre-implementation decline @ 1.16 m/yr, post-implementation rise @ 0.11 m/yr). This reduced rate of decline may be attributed to impact of artificial recharge to ground water through these structures.</i>

Gujarat

No. of AR Projects Implemented : 2

No. of AR Projects Impact Assessment Received : 2

Name of the scheme	Artificial Recharge structures in Watrak Watershed, Kheda/ Sabarkantha districts
Implementing Agency	Water Resource Development Corporation, Govt. of Gujarat
Block/Mandal/Taluk	Kapadbanga (Kheda District) / Virpur&Katlal (Sabarkantha District)
Category of block/mandal/ taluk	OE
District	Kheda District / Sabarkantha District
Approved Cost (in lakh)	166.71
Fund Utilised (in lakh)	137.12
Type & No. of Structures	96 (Rech. Trench-20, Abandoned open well-14, Abandoned T.Well-1, Check Dam-7, UGCD-3, Rech.Well (Existing)-41, Rech.Well (New)-10)
Structures completed	80
Piezometers	11
Type & No. of Structures dropped	16 structures with cost of Rs 29.59 have been dropped (Rech. Trench-2, Abandoned open well 9, Check Dam-3, Rech.Well (New)-2)
Impact of the scheme	<i>Total 26 observation wells & 11 Piezometers for monitoring stations has been fixed in watershed area. The rise in average water level is observed in the area annually and seasonally. Comparison between year 2011 and 2013 shows that there is a gradual rise in water level both annually (May to May) and seasonally (May-October). Overall average Rise in Water Level from May 2011 to May 2014 was observed to be 1.15 m in the watershed area which may be attributed to construction of artificial recharge.</i>



*Recharge well in Existing pond
Village : Vyasvasna
Ta- Kapadvanj Under Construction*



*Recharge well in Existing pond
Village : Vyasvasna Ta- Kapadvanj
After Construction*



*Renovation of Check
Dam (before)
Village : Viraniya
Ta- Kapadvanj*

*Renovation of Check Dam
(After)
Village : Viraniya
Ta- Kapadvanj*



Artificial Recharge structures in Watrak Watershed, Kheda/ Sabarkantha districts

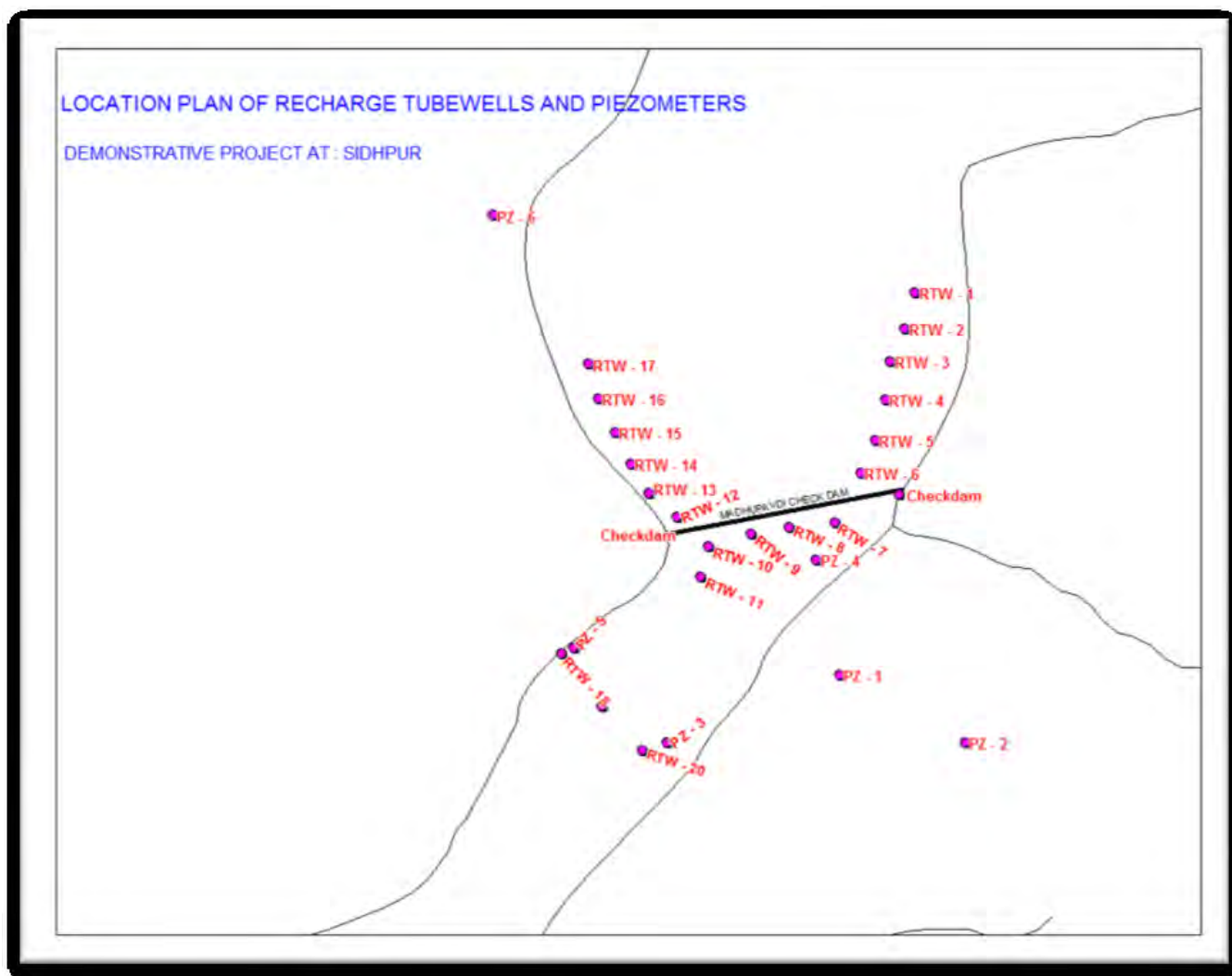


*Under Ground Check Dam
Village : Zanda Ta-
Kapadvanj Under and After
Construction*



Artificial Recharge structures in Watrak Watershed, Kheda/ Sabarkantha districts

Name of the scheme	Artificial Recharge structures in Patan district of Gujarat
Implementing Agency	Water Resource Development Corporation, Govt. of Gujarat
Block/Mandal/Taluk	Sidpur
Category of block/mandal/taluk	Over Exploited
District	Patan District
Approved Cost (in lakh)	149.53
Fund Utilised (in lakh)	149.53
Type & No. of Structures	20 (Recharge Tube well-20)
Structures completed	20 (Recharge Tube well-20)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>For study of long term behaviour, Six Piezometers were constructed under Demonstrative Project. Out of which, shallow aquifers were tapped in three piezometers and deep aquifers from 90 m to 180 m were tapped in remaining three.</i> <i>Long term monitoring was carried out for the study of behaviour of shallow and deep aquifers.</i> <i>Based on the numerical calculation water level in deep aquifers indicates 1.93 m fall during year 2013 and 1.97 m fall during year 2014.</i> <i>Before pump development the water levels showing in the hydrographs of Piezometers No.1, 2 & 3 are falling 0.65m, 1.51m and 0.15m respectively.</i> <i>To enhance the intake capacity all the 20 recharge structures are developed by suitable capacity of submersible pump. The work of development was started on 11/02/2015 and completed on 9/03/2015.</i> <i>After pump development the monthly comparison of water level with year 2014 indicates 2.49 m rise instead of falling. After pump development the water levels showing in the hydrographs of Piezometers No.1, 2 & 3 are rising trend of 8.03 m, 4.06 m and 8.28 m respectively.</i> <i>This is a remarkable improvement after conducting submersible pump development in the 20 recharge structures.</i>



Artificial Recharge structures in Patan district of Gujarat

Jammu & Kashmir

No. of AR Projects Implemented : 5

No. of AR Projects Impact Assessment received : 2

Name of the scheme	Artificial Recharge to Groundwater at Phangeri, Tehsil Hiranagar, Kathua Dist.
Implementing Agency	Soil Conservation Department, Govt of J & K
Block/Mandal/Taluk	Hiranagar
Category of block/mandal/taluk	Safe
District	Kathua Dist.
Approved Cost (in lakh)	30.83
Fund Utilised (in lakh)	30.83
Type & No. of Structures	1 (Check dam with associated structures of Gully Plugging - 200 Crate Work - 10)
Structures completed	1
Piezometers	2
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Water level data from the local village wells downstream of the check dam was collected from 17.09.2013 to 13.03.2015 shows rising trends trend.</i>



CHECK DAM AT PHANGERI, KATHUA

Name of the scheme	Artificial Recharge to Groundwater at Dabbie, Tehsil Hiranagar, DistKathua, J&K
Implementing Agency	Soil Conservation Department, Govt of J & K
Block/Mandal/Taluk	Hiranagar
Category of block/mandal/taluk	Safe
District	Kathua Dist.
Approved Cost (in lakh)	24.70
Fund Utilised (in lakh)	24.70
Type & No. of Structures	1 (Check dam with associated structures of Gully Plugging - 400 Crate Work - 20)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Water level data from the local village wells downstream of the check dam was collected from 17.09.2013 to 13.03.2015 shows rising trend.</i>



CHECK DAM AT DABBIE, KATHUA

Jharkhand

No. of AR Projects Implemented : 2

No. of AR Projects Impact Assessment received : 1

Name of the scheme	Artificial Recharge & Rain Water Harvesting Structures With in the Compounds of Indian School of Mines (ISM), Dhanbad, Jharkhand
Implementing Agency	CPWD, Govt of India
Block/Mandal/Taluk	Dhanbad
Category of block/mandal/taluk	Over Exploited
District	Dhanbad Dist.
Approved Cost (in lakh)	174.85645
Fund Utilised (in lakh)	189.46645 (additional amount Rs. 14.6100/- sanctioned and released)
Type & No. of Structures	54 (Recharge Pits with Recharge bore)
Structures completed	54
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Water level monitoring in the campus of ISM began with 15 recharge wells during the month of May 2013. As more and more recharge wells were constructed during the period of investigation in the study area, these were taken up for monitoring during subsequent monitoring. The data shows a rise in the mean pre-monsoon water level by 1.03 m in the year 2014 in comparison to that of the year 2013.</i> <i>During the course of the investigations made during the monsoon period, it was found that there was no overflow from the recharge pits. This suggests that the entire water being diverted to the pits is being recharged into the aquifers through the fractures and/or the weathered zone.</i> <i>As a result of the artificial recharge, increase in discharge of few wells within the campus which had reported very low discharge during the course of drilling has also been encountered.</i> <i>The roof top rainwater harvesting structure has led to zero wastage of water from the overhead tanks located on the roof of the various buildings in the campus of the ISM.</i>



Design of the recharge pit with a recharge well

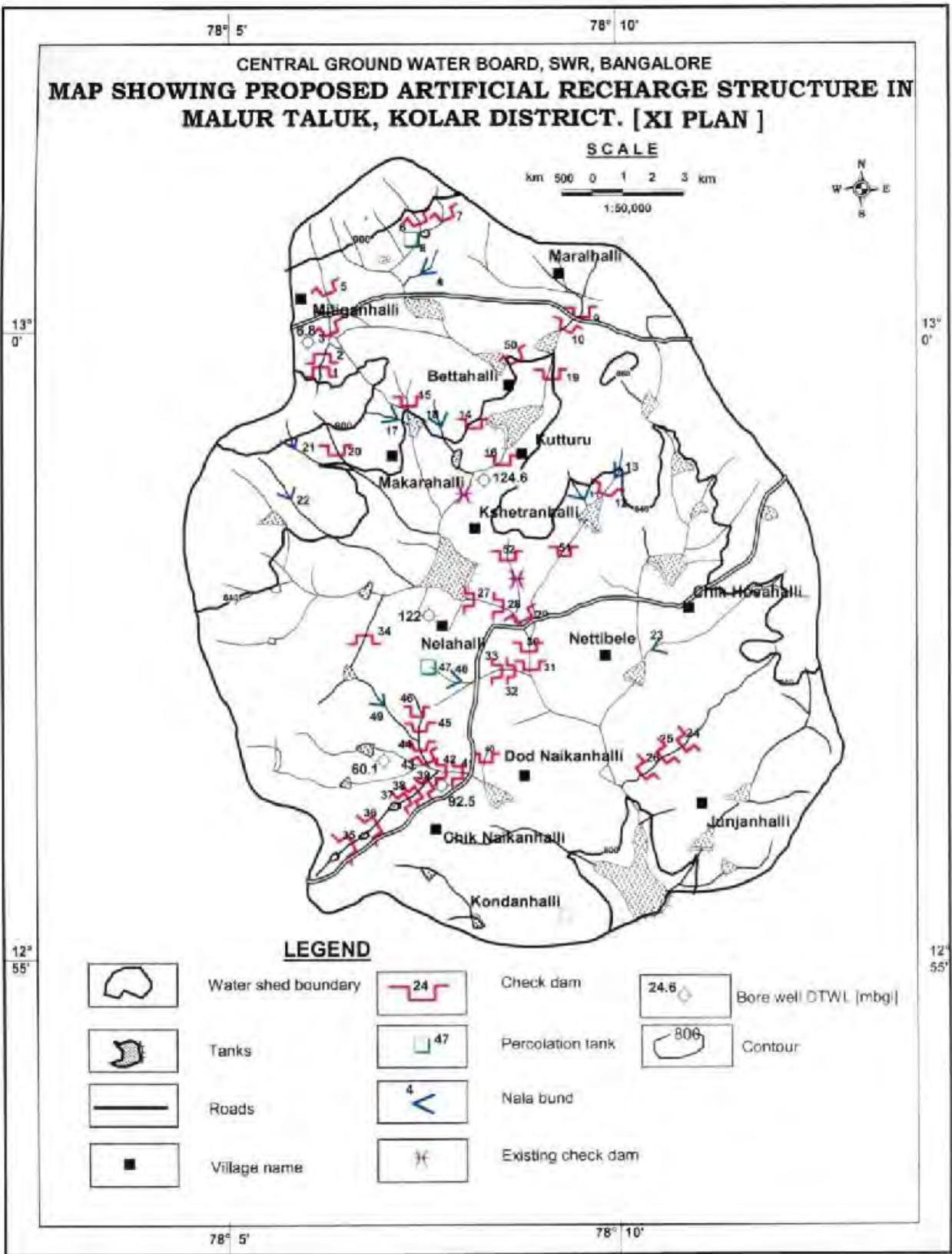
Artificial Recharge & Rain Water Harvesting Structures With in the Compounds of Indian School of Mines (ISM), Dhanbad, Jharkhand

Karnataka

No. of AR Projects Implemented : 6

No. of AR Projects Impact Assessment received : 5

Name of the scheme	Demonstrative Artificial Recharge Project in Malur Taluk (Phase-II), Kolar Dist, Karnataka
Implementing Agency	Water Shed Development Department, Govt. of Karnataka
Block/Mandal/Taluk	Malur
Category of block/mandal/taluk	Over Exploited
District	Kolar Dist.
Approved Cost (in lakh)	109.158
Fund Utilised (in lakh)	109.158
Type & No. of Structures	52 (Check dam-40, Percolation tank-2, Nala Bund-10)
Structures completed	52
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	Improvement in Water level <i>Dug wells showed rise between 0.77 to 2 m</i> <i>Bore wells showed rise between 1.0 to 1.76 m</i> Change in yield of bore wells <i>There was increase of sustainability of pumping from 50 minutes to one hour. Yield of wells has increased in the range of 0.25 to 2.5 lps.</i> Change in irrigated area <i>The command area of wells in the project area has increased in the range from 0.2 to 2hectares.</i>



Artificial Recharge Project in Malur Taluk (Phase-II), Kolar Dist, Karnataka



Check Dam constructed at Malur Taluk

Artificial Recharge Project in Malur Taluk (Phase-II), Kolar Dist, Karnataka



Percolation Tank constructed at Malur Taluk

Artificial Recharge Project in Malur Taluk (Phase-II), Kolar Dist, Karnataka



Nala Bund constructed in Malur Taluk

Artificial Recharge Project in Malur Taluk (Phase-II), Kolar Dist, Karnataka

Name of the scheme	Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka
Implementing Agency	University of Agricultural Science, Dharwad
Block/Mandal/Taluk	Dharwad
Category of block/mandal/taluk	Safe
District	Dharwad Dist.
Approved Cost (in lakh)	82.65
Fund Utilised (in lakh)	82.65
Type & No. of Structures	18 (Check dam-1, Form pond-5, Rech. pit-1, RTRWH-11)
Structures completed	18
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	Improvement in Water level: <i>Rise of water level between 0.58 to 2.93 m is observed in bore wells.</i> Change in Quality of Ground water: <i>Reduction in EC value was recorded in the range of 1.38 to 1.23 dS/cm.</i> Water Harvested Annually <i>Average quantity of water harvested annually works out as 80949 m³.</i> Improvement in Irrigation Potential <i>If this harvested water of 0.08 MCM is used for irrigation purposes it will create an irrigation potential of 8 hectares</i>



Check dam

Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka



Farm pond

Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka



Farm Pond with Recharge Shaft

Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka



Roof Top Rain Water harvesting

Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka



School children's visit to rain water harvesting structures

Rainwater Harvesting & Artificial Recharge to Groundwater in the campus of University of Agricultural Science, Dharwad, Karnataka

Name of the scheme	Demonstrative Artificial Recharge Project in Panmangore Sub Watershed, Bantwal, D.K. Dist, Karnataka
Implementing Agency	Water Shed Development Department, Govt. of Karnataka
Block/Mandal/Taluk	Bantwal
Category of block/mandal/taluk	Safe
District	Dakshin Kannada Dist.
Approved Cost (in lakh)	111.519
Fund Utilised (in lakh)	111.519
Type & No. of Structures	36 (Vented/Check dam-36)
Structures completed	36
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>For impact assessment studies, 6 observation wells were established in the project area for water levels monitoring. The monitoring started from January 2011 (Pre project period) and continued till May 2014. All the observation wells monitored have shown rise of water level in the range of 0.99 to 1.50 m after construction of vented dams. Wells located in villages Narikombu-Elabi and Shamboor-Sudhikar, which were dry before implementation of project, shown presence of water during pre-monsoons season.</i> <i>There is increase of sustainability of pumping in the range of 15 minutes to 30 minutes. Some of wells, which were discharging water intermittently during summer started yielding continuous water during the post project period in summer. Yield of wells has increased by 0.5 lps. The command area of wells in the project area has increased in the range of 0.5 to 1.0 Acres</i>



Vented Dams constructed in Panemangalore Sub-watershed

Artificial Recharge Project in Panmangore Sub Watershed, Bantwal, D.K. Dist, Karnataka

\Name of the scheme	Rain Water harvesting & Artificial Recharge to Ground Water for Bijapur Campus of University of Agriculture Sciences, Dharwar, Karnataka
Implementing Agency	University of Agricultural Science, Dharwad
Block/Mandal/Taluk	Bijapur
Category of block/mandal/taluk	Semi Critical
District	Bijapur Dist.
Approved Cost (in lakh)	73.230
Fund Utilised (in lakh)	73.230
Type & No. of Structures	4 (RTRWH with associated stru. Form pond with recharge shafts-2, farm ponds-2, Percolation pond -1, dug wells-1)
Structures completed	4 (RTRWH with associated stru. Form pond with recharge shafts-2, farm ponds-2, Percolation pond -1, dug wells-1)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	Improvement in Water level: <i>Rise of water level between 0.90 to 6.22 m is observed in bore wells.</i> Change in yield of bore wells: <i>Yield of wells has increased in the range of 20 to 45% (0.10-0.38lps).</i> <i>Many wells which were getting dry are now running round the year.</i> Change in Quality of Ground water: <i>Reduction in EC value was recorded in the range of 0.7 to 18.9% ie EC decreases in the range of 0.01 to 0.16 dS/m.</i>



Farm Pond

Rain Water harvesting & Artificial Recharge to Ground Water for Bijapur Campus of University of Agriculture Sciences, Dharwar, Karnataka



Recharge Pit Construction



Recharge Pit with Existing Bore Well

Rain Water harvesting & Artificial Recharge to Ground Water for Bijapur Campus of University of Agriculture Sciences, Dharwar, Karnataka



Percolation Pond under construction

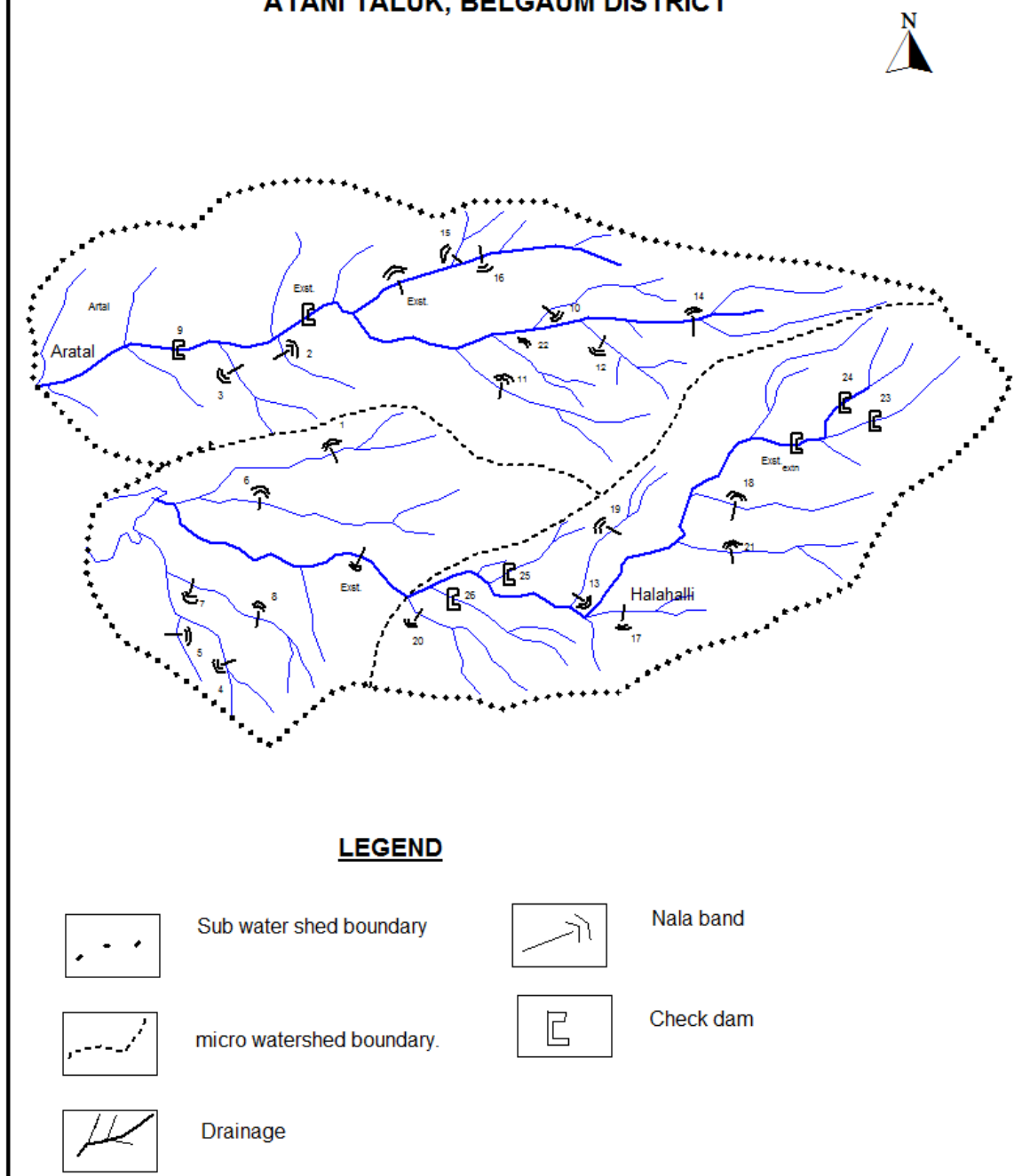


Percolation Pond after construction

Rain Water harvesting & Artificial Recharge to Ground Water for Bijapur Campus of University of Agriculture Sciences, Dharwar, Karnataka

Name of the scheme	Artificial Recharge in Arthal Water Shed, Athni Block Belgavi District, Karnataka
Implementing Agency	Water Shed Development Department, Govt. of Karnataka
Block/Mandal/Taluk	Athni
Category of block/mandal/ taluk	Over Exploited
District	Belgaum Dist.
Approved Cost (in lakh)	114.960
Fund Utilised (in lakh)	114.960
Type & No. of Structures	26 (Check dam-5, Nalabund-21)
Structures completed	26 (Check dam-5, Nalabund-21)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>To study the impact of the scheme, 21 dug wells and 7 bore wells were established for monitoring the water levels. It is observed that all the bore wells and dug wells in the project area have recorded rise of water level after implementation of the project. From the data it is observed that water level in dug wells showed rise in the range of 0.19 m to 3.75m during May 12 - May 13 and bore wells recorded rise in the range of 10.85 to 20.75 in the same period. Six dug wells which were dry since many years in the project area have got water column. Some wells, which were discharging water intermittently, are having continuous flow during the post project period. Yield of bore wells has increased in the range of 1.0 to 6 lps. The pumping duration of the wells has also increased from half an hour pumping to 45 minutes to 4 hr of pumping per day. The wells which are dry for many years and defunct were become active and are in use after the implementation of the scheme. There is a increase in the area of cultivation. There was increase in irrigated area of wells up to 0.75 acres.</i>

**Fig 6 . MAP SHOWING ARTIFICIAL RECHARGE STRUCTURES
IN ARATAL WATERSHED,
ATANI TALUK, BELGAUM DISTRICT**



CGWB /SWR /By ; Shakuntala

Artificial Recharge in Arthal Water Shed, Athni Block Belgavi District, Karnataka



C.G.W.B 2013-14 Village: Halalli -CD-III Sy No: 88
N: 16-43-882 E : 75-19-787



Check dams constructed in the sub watershed, Arthal Water Shed Artificial Recharge in Arthal Water Shed, Athni Block Belgavi District, Karnataka



Nala bund constructed in the sub watershed, Arthal Water Shed Artificial Recharge in Arthal Water Shed, Athni Block Belgavi District, Karnataka

Kerala

No. of AR Projects sanctioned : 7
No of Projects dropped : 1
No of Projects Impact Assessment Received : 6

Name of the scheme	Artificial Recharge in Kolathur-II, Bedadka Grama Panchayat, Kasargod, Kerala
Implementing Agency	District Collector, Kasargod, Govt. of Kerala
Block/Mandal/Taluk	Kasargod
Category of block/mandal/taluk	Critical
District	Kasargod Dist.
Approved Cost (in lakh)	8.750
Fund Utilised (in lakh)	8.750
Type & No. of Structures	1 (Rech pond & RWH storage tank of 1000 Lt capacity)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Most of the dug wells near the structure were dry during summer before the construction of the percolation tank. Rise in the water levels of wells located near the structure has been reported after completion of construction of the recharge structure. The pumping duration of the wells surrounding the structure is also increased by 1 to 2 hours/day.</i> <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge in the premises of the School has substantially improved the sustainability of both dug wells and bore wells in the downstream side of the school. Improvements, both in terms of yields of bore wells and pumping hours have been reported.</i>



A view of the site for construction of Percolation pond



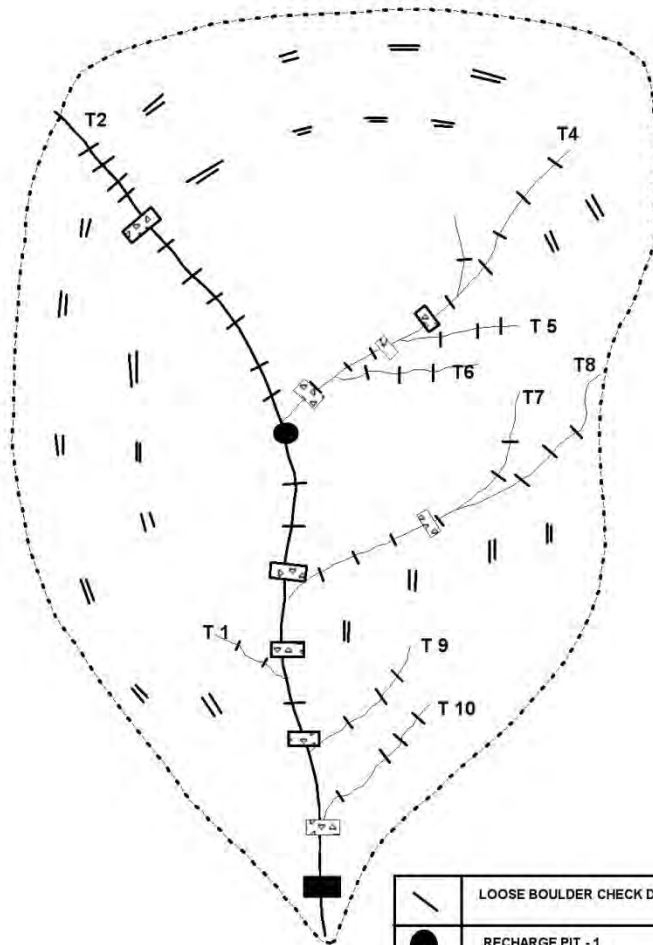
A view of the filled Percolation pond Artificial Recharge in Kolathur-II, Bedadka Grama Panchayat, Kasargod, Kerala



A view of the Ferrocement Tank
Artificial Recharge in Kolathur-II, Bedadka Grama Panchayat, Kasargod, Kerala

Name of the scheme	Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala
Implementing Agency	Soil Conservation Department, Govt. of Kerala
Block/Mandal/Taluk	Manjeshwar
Category of block/mandal/taluk	Semi-Critical
District	Kasargod Dist.
Approved Cost (in lakh)	24.50
Fund Utilised (in lakh)	21.02
Type & No. of Structures	83 (LBCD-72, GCD-9, Rech.tank-2)
Structures completed	56 (26 loose boulder check dams1 gabion Check Dam were dropped due to site conditions)
Piezometers	NIL
Type & No. of Structures dropped	27 (LBD-26, GCD-1) due to site conditions
Impact of the scheme	<i>A total of 9 observation wells were established in the downstream side of the project area to monitor the changes in water levels</i> <i>The water level data and the hydrographs indicate rise in water levels in the ground water abstraction structures in the area after implementation of the scheme, indicating replenishment of the aquifers. Wells which were regularly becoming dry during peak summer have ceased to be so and the water columns available during summer months have increased significantly. The benefits are expected to become clearer within a few more years.</i> Sustainability of wells <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge in the watershed has substantially improved the sustainability of both dug wells and bore wells in the downstream side of the watershed. Improvements, both in terms of yields of bore wells and pumping hours have been reported, prompting the farmers in the area to either increase the command area of wells or to go for more water-intensive crops such as plantain.</i> Improvement in Vegetative Cover in the Watershed <i>There is a gradual increase in the vegetative cover in the watershed as a whole, partly due to growth of natural vegetation under better soil moisture availability and partly due to growth of sapling planted as part of agrostology measures taken up during the project. The vegetative cover over the watershed is expected to improve over the years, resulting in reduced soil erosion and better percolation of rain water into the sub-surface.</i>

LOCATIONS OF ARTIFICIAL RECHARGE STRUCTURES



	LOOSE BOULDER CHECK DAM
	RECHARGE PIT - 1
	RECHARGE PIT - 2
	GABION CHECK DAM
	CONTOUR TRENCHES & BUNDS WITH AGRO-STOLOGY / TREE PLANTING.

NOT TO SCALE

Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala



Loose Boulder Check Dam across a small stream



**Gabion across a small stream Check Dam across a small stream
Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala**



Recharge Pond with Check Dam in the middle reaches of the main stream



Check Dam, Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala



A view of the Circular Recharge Pit with out water



A view of the Circular Recharge Pit filled with water

Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala



**Change in the vegetative cover over the watershed after implementation of artificial recharge & agrostology measures
Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala**



A view of the watershed after implementation of artificial recharge & agrostology measures

Artificial Recharge in ManjeshwarGovindPai Memorial College campus Kasargod, Kerala

Name of the scheme	Artificial Recharge in Pallipara/ Nileshtar at KayyurCheemeni, Kasargod dist. Kerala
Implementing Agency	Soil Conservation Department, Govt. of Kerala
Block/Mandal/Taluk	Nileshtwaram
Category of block/mandal/taluk	Safe
District	Kasargod Dist.
Approved Cost (in lakh)	1.450
Fund Utilised (in lakh)	1.450
Type & No. of Structures	1 (De-siltation of tank)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	Quantitative Water Recharge <i>The project area has a catchment of 20000 sq.m. The average rainfall for the last 12 years is 3500 mm in Kasargod district. Considering the average rainfall and runoff coefficient of 0.8, the quantity of rainwater that can be collected and recharged in to the proposed recharge pit is 52500 cubic metres.</i> Sustainability of wells <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge in the area has resulted in improved the sustainability of both dug wells and bore wells in the downstream area of the structure. Improvements, both in terms of yields of bore wells and pumping hours have been reported.</i>

Name of the scheme	Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2, Vidyanagar, Kasargoddist, Kerala
Implementing Agency	Soil Conservation Department, Govt. of Kerala
Block/Mandal/Taluk	Kasargod
Category of block/mandal/taluk	Critical
District	Kasargod Dist.
Approved Cost (in lakh)	5.850
Fund Utilised (in lakh)	5.850
Type & No. of Structures	2 (Recharge pit and Drainage feeder with Recharge pit)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>A total of 6 observation wells were established in the downstream side of the project area to monitor the changes in water levels including one pumping well of the school immediately below the downstream side of the structure.</i> <i>The water level data and the hydrographs indicate rise in water levels in the ground water abstraction structures in the area after implementation of the scheme, indicating replenishment of the aquifers. Wells which were regularly becoming dry during peak summer have ceased to be so and the water columns available during summer months have increased significantly. The benefits are expected to become more tangible within a few more years.</i> Sustainability of wells <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge in the school has substantially improved the sustainability of the school pumping well and other dug wells and bore wells in the downstream side of the Artificial Recharge structure. Improvements, both in terms of yields of dug wells and pumping hours have been reported.</i>



A View of Silt Collection Tank



A view of Channels connecting silt tank to Recharge Pit
Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2,
Vidyanagar, Kasargoddist, Kerala



View of Drop pit



A view of Channel

**Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2,
Vidyanagar, Kasargoddist, Kerala**



A View of Recharge Pit



A View of Recharge Pit

**Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2,
Vidyanagar, Kasargoddist, Kerala**



A View of Channel



A View of School supply well

**Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2,
Vidyanagar, Kasargoddist, Kerala**



A View of Observation well after the construction of AR structures in the School campus



A View of Observation well before the construction of AR structures in the School campus

Roof Top Rain Water Harvesting at Kendriya Vidyalaya No. 2, Vidyanagar, Kasargoddist, Kerala

Name of the scheme	Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya, Kanchangarh, Kasargoddist, Kerala
Implementing Agency	Soil Conservation Department, Govt. of Kerala
Block/Mandal/Taluk	Kanhangarh
Category of block/mandal/taluk	Semi Critical
District	Kasargod Dist.
Approved Cost (in lakh)	7.630
Fund Utilised (in lakh)	7.630
Type & No. of Structures	2 (Recharge pit and Drainage feeder with Recharge pit)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	Monitoring of water levels in observation wells <i>A total of 3 observation wells were established in the downstream side of the project area to monitor the changes in water levels.</i> <i>The water level data and the hydrographs did not indicate significant rise in water levels during the period of monitoring due to the fact that the ground water recharged through the structures is yet to replenish the ground water resources in the area on a regional scale. The impact of recharge is expected to become more tangible over a period of time.</i> Sustainability of wells <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge in the watershed has improved the sustainability of both dug wells and bore wells in the downstream side of the watershed. Improvements, both in terms of yields of bore wells and pumping hours have been reported.</i>



A View of Recharge Pit with collected Rain Water



**A view of water flowing through drainage channel to Recharge Pit
Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya,
Kanchangarh, Kasargoddist, Kerala**



A view of flowing water through drainage channel to Recharge Pit



**A view of the filled Recharge Pit through rain water collection channels
Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya,
Kanchangarh, Kasargoddist, Kerala**



A view of the collection channels



**A view of the filled Recharge Pit through rain water collection channels
Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya,
Kanchangarh, Kasargoddist, Kerala**



A view of the field rain water collection channels



A view of recharge pit before filling

**Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya,
Kanchangarh, Kasargoddist, Kerala**



Roof Top Rainwater Collection Arrangements



Roof Top Rainwater Collection Arrangements - A Closer View
Roof Top Rain Water Harvesting at JawaharNavodayaVidyalaya,
Kanchangarh, Kasargoddist, Kerala

Name of the scheme	Roof Top Rain Water Harvesting at Govt. college, Chittordist, Kerala
Implementing Agency	Groundwater Department, Govt. of Kerala
Block/Mandal/Taluk	Chittor
Category of block/mandal/taluk	Safe
District	Chittor Dist.
Approved Cost (in lakh)	4.390
Fund Utilised (in lakh)	4.390
Type & No. of Structures	1 (RTRWH with Recharge pit)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The quantum of rainwater harvested/recharged through the system has been computed as 0.15 MCM</i> Sustainability of wells <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures have revealed that the construction of artificial recharge structures in the campus has substantially improved the sustainability of both dug wells and bore wells in the campus. Improvements, both in terms of yields of bore wells and pumping hours have been reported.</i>



**Chittur Govt. College, Palakkad
Roof Top Rain Water Harvesting at Govt. college, Chittordist, Kerala**



**Ferro Cement Tank under construction
Roof Top Rain Water Harvesting at Govt. college, Chittordist, Kerala**



A view of the functional Ferro Cement TankFerro Cement Tank with Recharge Pit



Roof Top Rain Water Harvesting at Govt. college, Chittur, Kerala



**A view of the down-pipe for conveying rainwater to the storage tank.
Roof Top Rain Water Harvesting at Govt. college, Chittordist, Kerala**

Maharashtra

No. of AR Projects Implemented : 1

Name of the scheme	Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra
Implementing Agency	Dept. of Agriculture, Govt. of Maharashtra
Block/Mandal/Taluk	Nagpur
Category of block/mandal/taluk	Safe
District	Nagpur Dist.
Approved Cost (in lakh)	15.15
Fund Utilised (in lakh)	15.15
Type & No. of Structures	49 (LBS-32, Earthen-2, Gabion-8, Earthen NB-3, Cement NB-1 and Percolation tank-03)
Structures completed	49
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>All the Artificial Recharge and Water Conservation Structures have arrested the runoff significantly as indicated by the thick silt deposit at the base/bottom of each structure. This ultimately enriched the soil moisture content and recharged the ground water. Increase of soil moisture is witnessed by increase in biomass and thick vegetation cover in entire area of Rajbhawan campus. The objective of the project i.e., control of soil erosion and increase in soil moisture content which in turn would help in facilitating recharge and also growth of vegetation of biodiversity park at Rajbhawan was therefore fulfilled.</i> <i>Farm ponds were constructed at lowest level in the campus and during the inspection visit all the farm ponds, were found impounded with water, indicating that the structures is facilitating the recharge to ground water even after the monsoon.</i>



Gabion Structure-Before monsoon



Gabion Structure-After monsoon
Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra



Cement Nala Bandh-Before monsoon



Cement Nala Bandh -After monsoon
Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra



Cement Nala Bundh-Before monsoon



**Cement Nala Bundh -After monsoon
Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra**



Earthen Nala Bundh-Before monsoon



**Earthen Nala Bundh -After monsoon
Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra**



Gabion Structure-Before monsoon



Gabion Structure-After monsoon

Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra
Dense vegetation developed due to increase in soil moisture by these structures



Before Monsoon



After Monsoon

Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra



**Filled up Farm ponds-Repetitive filling of pond during the monsoon
Artificial Recharge to Groundwater in Raj Bhawan area, Nagpur, Maharashtra**

Nagaland

No. of AR Projects Implemented : 2

NO of Projects Impact Assessment Received : 2 (Combined Report)

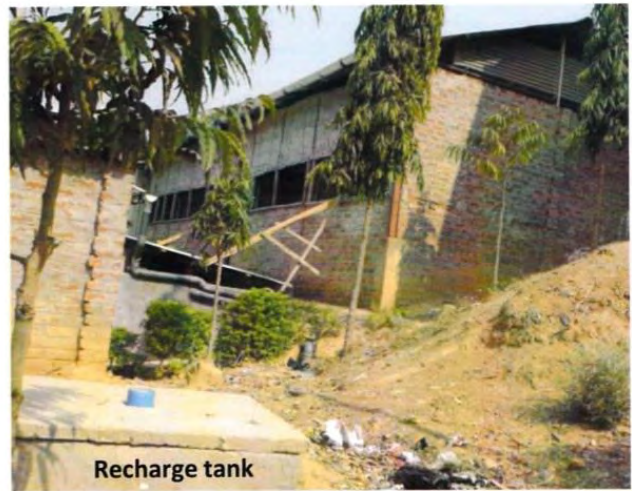
Name of the scheme	Artificial recharge to GW through RTRWH in and around Dimapur, Dimapur town & parts of Wokha district, Nagaland (Two Projects)
Implementing Agency	Directorate of Geology & Mining, Govt. of Nagaland
Block/Mandal/Taluk	Medziphema, Dimapur District & Sanis, Wokha District
Category of block/mandal/taluk	Safe
District	Dimapur Dist & Wokha District
Approved Cost (in lakh)	224.14 (113.06+ 111.08)
Fund Utilised (in Lakhs)	224.14
Type & No. of Structures	64 (RTRWH) (30 +34)
Structures completed	64
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Total volume of 37,200 m³/annum rain water has been harvested from the total roof area of about 30,000 sq.m with an average annual rainfall of 1100 mm in Dimapur and 2000 mm in Wokha area.</i> <i>The water in dug wells/shallow wells in and around the recharge wells were not dried up unlike earlier lean period and water levels remain stable. This indicates satisfactory recharging and proper functioning of the recharge structures/wells.</i> <i>The project was implemented with the participation of the people. Conservation and enhancing ground water through artificially recharging to ground water from rain water was a new scheme which was appreciated by the beneficiaries.</i> <i>The project had benefited to scores of needy people institutions/ centers/hospital/community halls & church as they started availing the facilities of rain water harvesting and storage tanks.</i> <i>Public in general around the project have realized the importance of rain water harvesting with advance equipments & materials as well as conservation of ground water through artificially recharging which was the objective of the project.</i>



DLSC Stadium, Dimapur



Aoyimkum village Rangapahar, Dimapur



Recharge tank



MGM H.S. School, Dimapur



St. Paul H.S. School, Dimapur



DBS H.S. School, Dimapur



AO Mission High School, Dimapur



Aoyimti Church 3rd mile , Dimapur



Dzukou Water Treatment Plan, Sovima, Dimapur.



Holy Redeemer Hospital Chumukedima, Dimapur





DBHSS Wokha



Don Bosco Youth Centre, Wokha



Civil Hospital, Wokha

Odisha

No. of AR Projects Implemented : 14

No. of AR Projects Impact Assessment received : 12

Name of the scheme	Artificial Recharge Scheme for Ganada Watershed (Part), Korei block, Jajpur Dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Korei
Category of block/mandal/taluk	Safe
District	Jajpur District
Approved Cost (in lakh)	11.27
Fund Utilised (in Lakhs)	11.27
Type & No. of Structures	1 (Cross bund with 4 recharge wells)
Structures completed	1
Piezometers	
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The impact of recharge through the Recharge Tube Wells and check dam established in the command as well as catchments area of the project were monitored regularly. The pre-project bench marked parameters have been evaluated against the monitoring data of the same parameters of the post-project period to come to the conclusion of the various impact. Localized rain water harvesting systems like check dam, Recharge tank etc. are an effective solution to the water crisis. The most impressive impact of the project is the demand for extension of the project to cover the entire watershed by the people of the locality & their willingness for effective participation. They are now really sensitized for the conservation and management of valuable ground water resources of their locality.</i> Ground Water Resources of the Project Area is augmented by 0.6024 HM Rise in Summer Water Table of the Project Area by 0.06 M



RECHARGE TUBE WELL AT BIRAMANIPUR



CHECK DAM OVER GANDA NALLAH

Artificial Recharge Scheme for Ganada Watershed (Part), Korei block, JajpurDist, Odhisha

Name of the scheme	Artificial Recharge Scheme for Himtira Watershed (Part), Kishornagar block Angul Dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Kishornagar
Category of block/mandal/taluk	Safe
District	Angul District
Approved Cost (in lakh)	13.15
Fund Utilised (in Lakhs)	13.15
Type & No. of Structures	1 (check dam with associate structures- recharge tank, recharge. Pit and recharge wells)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The impact of recharge through the recharge tanks, Recharge Bore Wells and check dam established in the command as well as catchments area of the project were monitored regularly. The pre-project bench marked parameters have been evaluated against the monitoring data of the same parameters of the post-project period to come to the conclusion of the various impact. Localized rain water harvesting systems like check dam, Recharge tank etc. are an effective solution to the water crisis. The most impressive impact of the project is the demand for extension of the project to cover the entire watershed by the people of the locality & their willingness for effective participation. They are now really sensitized for the conservation and management of valuable ground water resources of their locality.</i> Ground Water Resources of the Project Area is augmented by 4.500 HM Rise in Summer Water Table of the Project Area by 0.15 M



**CROSS BUND AT TURUDA DURING RAINY SEASON -Himtira Watershed, Kishornagar block
AngulDist, Odisha**



RECHARGE TANK AT ANGAPADA Himtira Watershed, Kishornagar block AngulDist, Odisha



RECHARGE BORE WELL NEAR CROSS BUND AT TURUDA-Himtira Watershed, Kishornagar block AngulDist,



CHECK DAM AT TURUDA-Himtira Watershed, Kishornagar block AngulDist, Odisha

Name of the scheme	Artificial Recharge Scheme for Ligarkat Watershed (Part), Banerpal block, Angul Dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Banerpal
Category of block/mandal/ taluk	Safe
District	Angul District
Approved Cost (in lakh)	16.494
Fund Utilised (in Lakhs)	16.494
Type & No. of Structures	7 (Check dam-1, recharge tank-4, recharge wells-2)
Structures completed	7
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The impact of recharge through the recharge tanks, Recharge Bore Wells and check dam established in the command as well as catchments area of the project were monitored regularly. The pre-project bench marked parameters have been evaluated against the monitoring data of the same parameters of the post-project period to come to the conclusion of the various impact. Localized rain water harvesting systems like check dam, Recharge tank etc. are an effective solution to the water crisis. The most impressive impact of the project is the demand for extension of the project to cover the entire watershed by the people of the locality & their willingness for effective participation. They are now really sensitized for the conservation and management of valuable ground water resources of their locality.</i> Ground Water Resources of the Project Area is augmented by 1.174 HM Rise in Summer Water Table of the Project Area by 0.08 M



RECHARGE TANK AT NUASAH-I -Ligarkat Watershed, Banerpal block, AngulDist, Odisha



RECHARGE TANK AT BUDHAPANKA-II -Ligarkat Watershed, Banerpal block, AngulDist, Odisha



**RECHARGE BORE WELLS AT BUDHAPANKA-I & II-Ligarkat Watershed, Banerpal block,
AngulDist,**

Name of the scheme	Artificial Recharge Scheme for UppalairaiDesibatia Watershed (Part), Gosani block Gajapati Dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Gosani
Category of block/mandal/taluk	Safe
District	Gajapati District
Approved Cost (in lakh)	62.020
Fund Utilised (in Lakhs)	62.020
Type & No. of Structures	11 (Check dam-5, recharge tank-6)
Structures completed	11
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The ground water table monitoring data for the period spanning last two years (2014-2015) are the key indicators of the impact of the project on the ground water regime of the region. The enhanced ground water recharge has on an average improved the pre-monsoon water table from 8.38 to 7.89 Meters indicating thereby rise of 0.5 m. People are also taking up summer crops in limited patches in the vicinity of the recharge structures.</i> <i>This ecological impact in the project area has also lead to improvement of soil moisture and created a verdant landscape in summer. People are quite happy to find water in their wells during the worst part of the summer (April-May). They have been eagerly explaining the positive effect of the project to all visiting teams of officers representing Govt. of India / Govt. of Odisha with a hope to increase the density of these artificial recharge structures in the watershed so that they can harvest more water to meet their farming requirements.</i>



Pre-Project



Post-Project: Recharge Tank: UppalairaiDesibatia Watershed, Gosani block GajapatiDist, Odisha



Recharge Dug well-UppalairaiDesibatia Watershed, Gosani block GajapatiDist, Odisha

Name of the scheme	Artificial Recharge Scheme for Burudi Watershed (Part), Ganjam block
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Ganjam
Category of block/mandal/taluk	Safe
District	Ganjam District
Approved Cost (in lakh)	55.130
Fund Utilised (in Lakhs)	55.130
Type & No. of Structures	5 (Recharge tank-5)
Structures completed	5
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The ground water table monitoring data for the period spanning last two years (2014-2015) are the key indicators of the impact of the project on the ground water regime of the region. The enhanced ground water recharge has on an average improved the pre-monsoon water table from 7.29 to 6.73 meters indicating rise of 0.56 m. This is the most vital environmental aspect of the project. People are also taking up summer crops in limited patches in the vicinity of the recharge structures.</i> <i>This ecological impact in the project area has also lead to improvement of soil moisture and created a verdant landscape in summer. People are quite happy to find water in their wells during the worst part of the summer (April-May).</i>



Pre-Project



Post-Project
Recharge Tank, Burudi Watershed, Ganjamblock, Odisha



Pre-Project



Post-Project
Recharge Tank, Burudi Watershed, Ganjamblock, Odisha



Recharge Dug Well ,Burudi Watershed, Ganjamblock,Odisha

Name of the scheme	Artificial Recharge Scheme for BolagarhNallahWatershed ,Bolagarh block, Khurda dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Bolagarh
Category of block/mandal/ taluk	Safe
District	Khurda District
Approved Cost (in lakh)	182.130
Fund Utilised (in Lakhs)	182.130
Type & No. of Structures	9 (Recharge tank with Shaft)
Structures completed	9
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The post-project period is followed by a very bad monsoon during 2015 experiencing deficit of rainfall. However, as observed during post-monsoon period i.e. during October 2015 there seem to be an impact of such application of recharge technique considering the quantum of rainfall during monsoon season. In the absence of normal monsoon, the project areas did not witness much agricultural activities. However, open wells and bore wells in the project areas has catered the need of the villagers without any significant depletion of ground water levels. The monitoring and assessment of impact of recharge structures constructed in different locations in the project areas shall continue for next 3 to 5 years in order to obtain adequate data to justify their usefulness for the enhancement of ground water storage in the area, particularly during summer. It is expected that there shall be visible impact of recharge due to constructed structures during 2016.</i>



BolagarhNallahWatershed ,Bolagarh block, Khurdadist



BolagarhNallahWatershed ,Bolagarh block, Khurdadist



BolagarhNallahWatershed ,Bolagarh block, Khurdadist

Name of the scheme	Artificial Recharge Scheme for Karmeli mini Watershed ,Saintala block, Bolangir dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Saintala
Category of block/mandal/taluk	Safe
District	Bolangir District
Approved Cost (in lakh)	23.480
Fund Utilised (in Lakhs)	23.480
Type & No. of Structures	12 (Check dam, Percotank,Rech tank, Rech.well, LBD, Recharge pit)
Structures completed	12
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The groundwater table monitoring data for the period spanning last three years are the key indicators of the impact of the project on the groundwater regime of the mini watershed. The enhanced groundwater recharge has on an average raised the pre-monsoon water table by 0.06 Meters and in post monsoon by 0.21 m. compared to the year average of 2007-2009. This is the most vital environmental aspect of the project. People are also taking up summer crops by lifting water from the recharge structures.</i> <i>This ecological impact in the project area has also lead to improvement of soil moisture status and created grassy patches. People are quite happy to find water in their drinking water borewells during the summer.It was estimated to be 6.45 Hectare Metres (HM) of ground water resource has been is augmented during post-project period.</i>



Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha



Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha



PERCOLATION TANK- Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha



RECHARGE TANK -Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha



RECHARGE TANK -Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha



LOOSE BOULDER CHECK DAM--Karmeli mini Watershed ,Saintala block, Bolangirdist, Odisha

Name of the scheme	Roof Top Rain Water Harvesting in the DRDA Office Building in Collectorate Campus, Khurda dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Khurda
Category of block/mandal/taluk	Safe
District	Khurda District
Approved Cost (in lakh)	5.120
Fund Utilised (in Lakhs)	5.120
Type & No. of Structures	1 (RTRWH with Recharge Shaft & Trench-1)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The average normal rainfall of Khurda Municipality is 1184.00 mm. The total roof area of the building is 730 sq. m. So the total water available for recharge is 864.00 Cum during the year. Assuming that 70% of this available water i.e 604 Cum can be recharged during the year. The additional ground water to be made available is worked out to be 181.2 Cum approx.</i>



COLLECTION PIPE LINES ON BACK SIDE OF DRDA OFFICE BUILDING, COLLECTORATE CAMPUS, KHURDA DIST.



[ON-LINE FILTER INSTALLED] OFFICE BUILDING, COLLECTORATE CAMPUS, KHURDA DIST



[RECHARGE BORE WELL INSTALLED IN DRDA OFFICE CAMPUS] OFFICE BUILDING, COLLECTORATE CAMPUS, KHURDA DIST



[RECHARGE BORE WELL] OFFICE BUILDING, COLLECTORATE CAMPUS, KHURDA DIST

Name of the scheme	Roof Top Rain Water Harvesting in the Govt. Women's Polytechnic Hostel Building, Berhampur, Rangeilunda block Ganjam dist.Odhisha
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Rangeilunda block
Category of block/mandal/taluk	Safe
District	Ganjamdist
Approved Cost (in lakh)	5.683
Fund Utilised (in Lakhs)	5.683
Type & No. of Structures	1 (RTRWH with Recharge Shaft & Trench-3)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Ground Water Resources of the Project Area is augmented by 0.35 ham</i> <i>Rise in Summer Water Table of the Project Area by 0.33 m</i>



Pipe Line



Filter Cum Collection Chamber

**Roof Top Rain Water Harvesting in the Govt. Women's Polytechnic Hostel Building,
Berhampur, Rangeilunda block Ganjam dist.**

Name of the scheme	Roof Top Rain Water Harvesting in the premises of the Office Building of Hydrogeologist, GWS & I Division at Danipali, Dhankauda block, Sambalpur dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Dhankauda block,
Category of block/mandal/taluk	Safe
District	Sambalpur dist
Approved Cost (in lakh)	5.950
Fund Utilised (in Lakhs)	5.950
Type & No. of Structures	1 (RTRWH with Recharge Shaft & Trench-1)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The Water level monitoring shows that in pre-monsoon, there is a rise of 0.29 to 0.33 m in water level and in post -monsoon, there is a rise of 0.34 to 0.36 m in water level in comparison to pre scenario and present water level status.</i>



Roof Top Rain Water Harvesting in the premises of the Office Building of Hydrogeologist, GWS & I Division at Danipali, Dhankauda block, Sambalpur dist.

Name of the scheme	Artificial Recharge Scheme for PandripathaNala Micro Watershed, Jharsuguda block, Jharsuguda dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Jharsuguda block,
Category of block/mandal/taluk	Safe
District	Jharsugudadist
Approved Cost (in lakh)	16.70
Fund Utilised (in Lakhs)	16.70
Type & No. of Structures	2 (Cross bed-1, Recharge tank-1)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The Water level monitoring shows that in pre-monsoon,there is a rise of 0.06 to 0.48 mtr. in water level and in post -monsoon ,there is a rise of 0.07 to 0.32 mtr in comparison to pre scenario and present water level status.</i>



**Artificial Recharge Scheme for PandripathaNala Micro Watershed, Jharsuguda block,
Jharsuguda dist.**

Name of the scheme	Artificial Recharge Scheme for KatikelaNala Micro Watershed, Jharsuguda block, Jharsuguda dist.
Implementing Agency	Directorate of Groundwater surveys & Investigation, Govt. of Odisha
Block/Mandal/Taluk	Jharsuguda block,
Category of block/mandal/taluk	Safe
District	Jharsugudadist
Approved Cost (in lakh)	35.185
Fund Utilised (in Lakhs)	35.185
Type & No. of Structures	2 (Recharge tank-2 with Rech well)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The Water level monitoring shows that in pre-monsoon, there is a rise of 0.55 to 0.59 mtr. in water level and in post -monsoon 0.30 to 0.73 m in comparison to pre scenario and present water level status.</i>



Artificial Recharge Scheme for KatikelaNala Micro Watershed, Jharsuguda block, Jharsuguda dist.

Rajasthan

No. of AR Projects Implemented : 49 (16 scheme dropped)
No of Projects Impact Assessment received : 3

Name of the scheme	Roof Top Rainwater Harvesting structures at Govt. Mahila Polytechnical Collage, Bikaner city, Dist Bikaner
Implementing Agency	Water Resource Dept, Govt. of Rajasthan
Block/Mandal/Taluk	Bikaner
Category of block/mandal/taluk	Over-Exploited
District	Bikaner Dist.
Approved Cost (in lakh)	11.889
Fund Utilised (in lakh)	11.889
Type & No. of Structures	2 (Reservoir tank - 1 Bore well & filter chamber - 1)
Structures completed	2
Piezometers	
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The total annual quantity of rain water to be harvested /recharged from existing structure will be 1474 m³ per year which will be available for drinking and other domestic use</i> <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures revealed that the construction of artificial recharge in the area has substantially improved the sustainability of wells in the surrounding area.</i>



Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner



**Circular Recharge Pit with filter pit & recharge tube well
Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner**



Reservoir (collection) Tank
Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner



De-silting Pit
Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner



Water Channel with siphon pit.
Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner



Water Channel with siphon pit.
Govt. MahilaPolytechnical Collage, Bikaner city, Dist Bikaner

Name of the scheme	Roof Top Rainwater Harvesting structures at Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner
Implementing Agency	Water Resource Dept, Govt. of Rajasthan
Block/Mandal/Taluk	Bikaner
Category of block/mandal/taluk	Over-Exploited
District	Bikaner Dist.
Approved Cost (in lakh)	13.898
Fund Utilised (in lakh)	13.898
Type & No. of Structures	2 (Reservoir tank - 1 Bore well & filter chamber - 1)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The total annual quantity of rain water to be harvested /recharged from existing structure will be 717 m³ per year which will be available for drinking and agriculture use. Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures revealed that the construction of artificial recharge in the area has substantially improved the sustainability of wells in the surrounding area.</i>



Circular Recharge Pit with filter pit & recharge tube well
Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner



Circular Recharge Pit with filter pit & recharge tube well
Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner



De-silting Pit- Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner



Siphon Pit-Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner



Channel for roof top run off collection
Govt. Polytechnical Collage (Boys), Bikaner city, Dist Bikaner

Name of the scheme	Roof Top Rainwater Harvesting structures at CE, IGNP Office Building, Bikaner city, Dist Bikaner
Implementing Agency	Water Resource Dept, Govt. of Rajasthan
Block/Mandal/Taluk	Bikaner
Category of block/mandal/taluk	Over-Exploited
District	Bikaner Dist.
Approved Cost (in lakh)	8.515
Fund Utilised (in lakh)	8.515
Type & No. of Structures	2 (Reservoir tank - 1 Bore well & filter chamber - 1)
Structures completed	2
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The total volume of runoff received from the roof top will be harvested and recharged will be taken in to account for total recharge in the area for the impact assessment. The total annual quantity of rain water to be harvested /recharged from existing structure will be 1474 m³ per year which will be available for drinking and other domestic use.</i> <i>Enquiries with the local residents one year after implementation of the scheme on the improvement in the performance of ground water abstraction structures will be revealed that the construction of artificial recharge in the area has substantially improved the sustainability of wells in the surrounding area.</i>



Circular Recharge Pit with filter pit & recharge tube well
CE, IGNP Office Building, Bikaner city, Dist Bikaner



Circular Recharge Pit with filter pit & recharge tube well

CE, IGNP Office Building, Bikaner city, Dist Bikaner



De-silting Pit-CE, IGNP Office Building, Bikaner city, Dist Bikaner



Water Channel with siphon pit-CE, IGNP Office Building, Bikaner city, Dist Bikaner



Water Channel with siphon pit-CE, IGNP Office Building, Bikaner city, Dist Bikaner

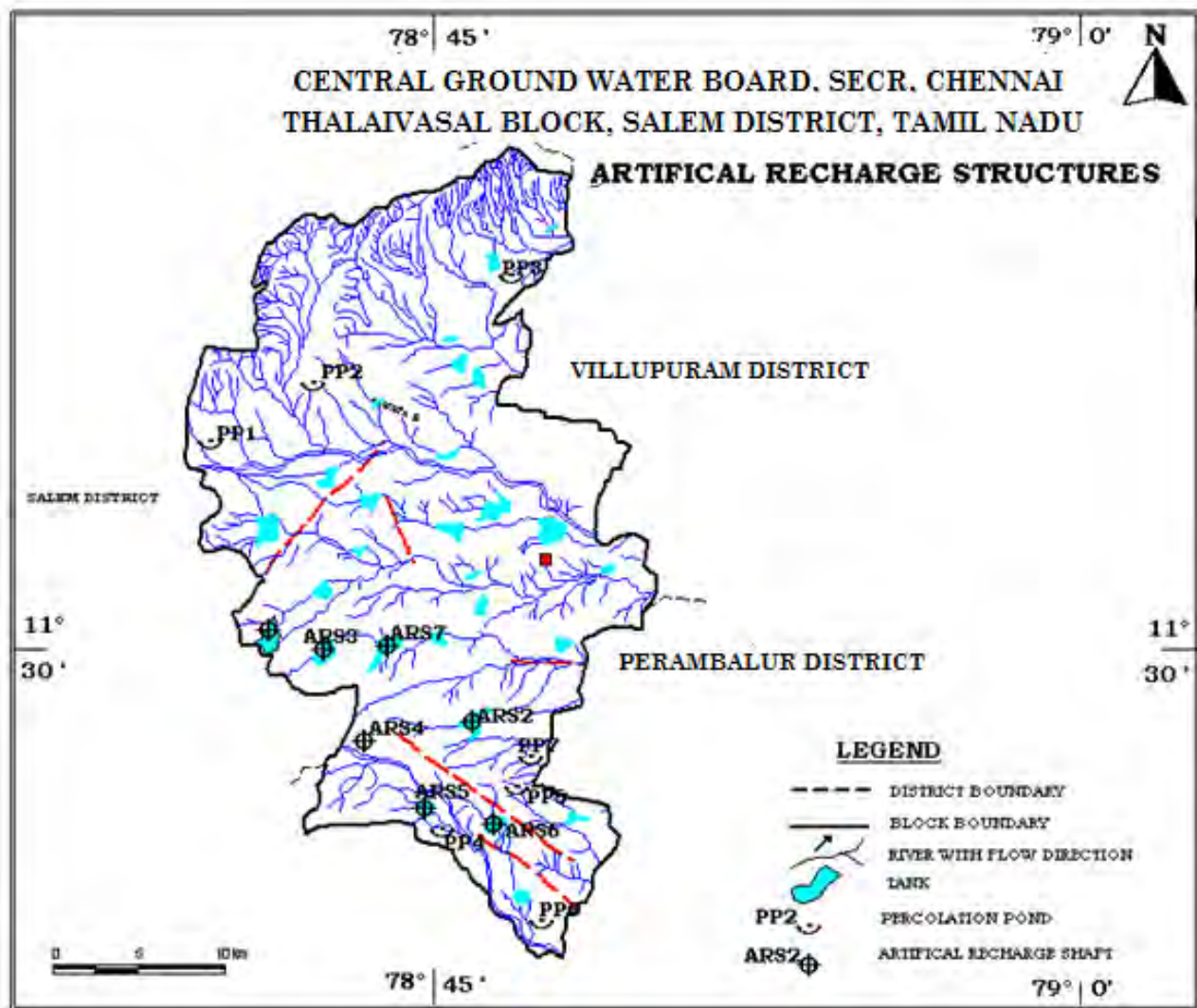


Water Channel for collection of roof top runoff-CE, IGNP Office Building, Bikaner city, Dist Bikaner

Tamil Nadu

No. of AR Projects Implemented : 4
No. of AR Projects Impact Assessment received : 4

Name of the scheme	Artificial Recharge to Groundwater inThalaivasal Block, Selam District, Tamil Nadu
Implementing Agency	PWD, Water Resources Organisation, Govt of Tamil Nadu
Firka	Thalaivasal Block
Category of Firka	
District	Selam District
Approved Cost (in lakh)	111.00
Fund Utilised	111.00
Type & No. of Structures	27 (Rech. Pit with Bore well-25, Rech.Shaft-2)
Structures completed	27
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Sixteen dug wells have been fixed as key wells near by the Artificial Recharge Structures in Thalaivasal Block. The minimum rise in water level is 0.29 m and the maximum rise in water level is 9.97 m. The average rise in water level is 3.119 m. The cropped are increased from 44 to 58 Acres, about 13 acre i.e., 130% (includes second crop).</i>





Kattukottai Percolation Pond-Thalaivasal Block, Selam District, Tamil Nadu



MANIVIZHANDAN PERCOLATION POND-Thalaivasal Block, Selam District, Tamil Nadu

Name of the scheme	Artificial Recharge to Groundwater through road side and open space RWHS in Coimbatore city, Coimbatore Block, Dist. Coimbatore, Tamil Nadu
Implementing Agency	District Collector, Coimbatore, Govt of Tamil Nadu
Firka	Coimbatore Block
Category of Firka	Over Exploited
District	Coimbatore District
Approved Cost (in lakh)	100.00
Fund Utilised	100.00
Type & No. of Structures	215 (Rounded and Rectangular structures)
Structures completed	215
Piezometers	Nil
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>It is expected to harvest 215 M.Liters of runoff water per season which helps to bring up the groundwater table from 18 m down to 5 m thus making a 13 m rise in water table.</i> <i>Rainwater harvesting replenish the groundwater table and enables the dug wells and bore wells to yield in a sustained manner.</i> <i>The recharge structures will help reducing the presence of salinity and hardness of water.</i> <i>Flooding of low lying areas, roads and streets etc., can be avoided to a large extent thereby avoiding traffic jam and accidents.</i>

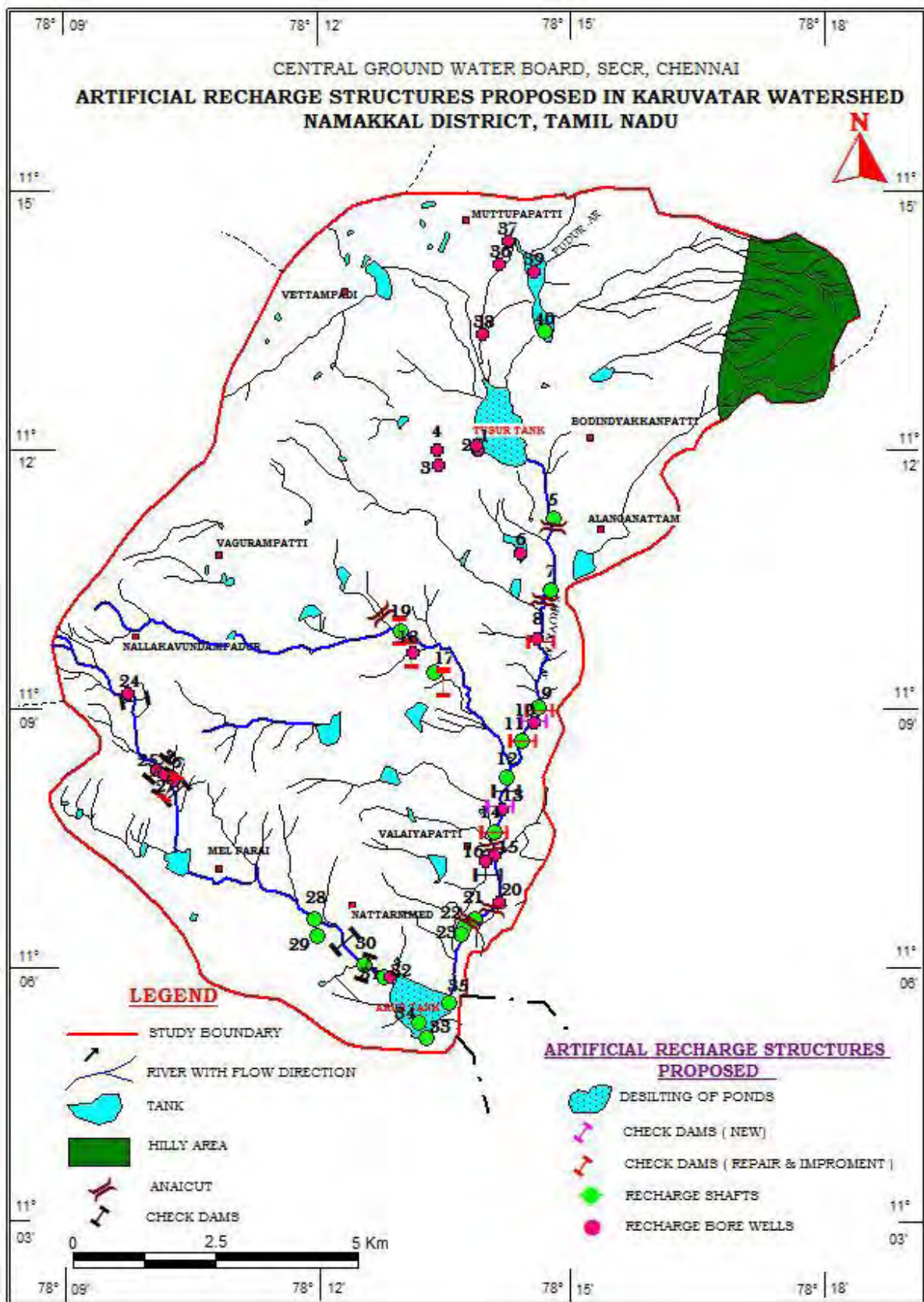


**Rectangular Structure-
RWHS in Coimbatore city, Coimbatore Block, Dist. Coimbatore, Tamil Nadu**



**Circular Structure
RWHS in Coimbatore city, Coimbatore Block, Dist. Coimbatore, Tamil Nadu**

Name of the scheme	Artificial Recharge to Groundwater in Karuvatur watershed, NamakkalDist, Tamil Nadu.
Implementing Agency	PWD, Water Resources Organisation, Govt of Tamil Nadu
Firka	Namakkal, Mohanar, Permathi Blocks
Category of Firka	Over-Exploited
District	Namakkal District
Approved Cost (in lakh)	275.35
Fund Utilised	275.35
Type & No. of Structures	30 (Recharge shaft with BW-20, Check dam-10, De-siltation tank-2)
Structures completed	30
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	30 Nos. of dug wells were fixed, as key wells, near the Artificial Recharge Structures in Karuvatur Watershed. Prior to implementation of the scheme depth to water level during pre monsoon was deeper (in the range of 4.55 to 20.86 mbgl) whereas during post implementation it has become relatively shallow (in the range of 2.10 to 17.55 mbgl). Likewise Prior to implementation of the scheme depth to water level during post monsoon was deeper (in the range of 0.95 to 16.10 mbgl) whereas during post implementation it has become relatively shallow (in the range of 0.20 to 12.95 mbgl). Hence there is Positive Impact on groundwater levels. The annual fluctuation between the pre-monsoon periods showed rise in the range of 0.84 to 3.40 m. The post-monsoon rise was also noticed in the range of 0.55 to 3.90 m only. Improvement, both in terms of yields of bore wells and pumping hours, have been reported in the dug wells and bore wells available in the vicinity of the structures, after implementation of the scheme. Enquiries with the local farmers confirm the substantial improvement in the sustainability of dug wells and bore wells available in the vicinity of the structures. Increase in cropped area and the change in water intensive crops were observed in the vicinity of the structures due to the availability of more groundwater in space and time. Gradual increase in the vegetative cover in the vicinity of the structures was observed due to soil moisture availability. The vegetative cover is expected to reduce soil erosion and better percolation of rain water into the sub-surface.





**Different Stages of Construction of Artificial Recharge Structures
Karuvatur watershed, NamakkalDist, Tamil Nadu.**



**Different Stages of Construction of Artificial Recharge Structures
Karuvatur watershed, NamakkalDist, Tamil Nadu**

Name of the scheme	Rain water Harvesting in the premises of the NITTTR, Taramani, Chennai city, Tamil Nadu.
Implementing Agency	NITTTR, Taramani, Chennai
Firka	Chennai Block
Category of Firka	Safe
District	Chennai District
Approved Cost (in lakh)	40.00
Fund Utilised	40.00
Type & No. of Structures	1 (RTRWH)
Structures completed	1
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>Rise in water level from pre-monsoon to post-monsoon was 1.55 m during 2013-14 and rise in water level was maintained during May 2014-15 also, i.e., 0.95m. The consecutively the pre-monsoon water level showed a raising trend from 5.9 m to 4.87 m bgl, for the period May-13 to May-15.</i> <i>Storage in sump has a direct bearing on the financial aspect of the Institute. There is a significant savings on the amount of water purchased from the open market. Two loads of water is purchased @ Rs.1,000/- per load. Each load is bringing 12,000 liters of water from outside source. The roof top rainwater harvested and stored in the sump in a year is 44,10,000 liters which makes about 367 loads. ThusRs. 3,67,000/- will be a sure savings on this component alone. Institute incurs about Rs.7,20,000/- on purchase of water every year. Thus about 50% of the expenditure is saved every year. Apart from rise in the groundwater regime, rain water collected in the pond is also used for watering of green belt area of during lean period and washing purpose.</i>



**Collection, conveyance and Filtering Unit of roof top rainwater harvesting
Rain water Harvesting in the premises of the NITTTR, Taramani, Chennai city, Tamil Nadu.**



**Collection, conveyance and Filtering Unit of roof top rainwater harvesting
Rain water Harvesting in the premises of the NITTTR, Taramani, Chennai city, Tamil Nadu.**

Telangana

No. of AR Projects Implemented : **4**
No of Projects Impact Assessment Received : **2**

Name of the scheme	Rainwater Harvesting in the premises of Kakatiya University, Warangal, Telangana.
Implementing Agency	Kakatiya University, Govt of Telangana
Block/Mandal/Taluk	Warangal Block
Category of block/mandal/taluk	Safe
District	Warangal District
Approved Cost (in lakh)	75.180
Fund Utilised (in lakh)	75.180
Type & No. of Structures	33 (Checkdam-9,Perco.tank-4,Gabion str-1and RTRWH-19)
Structures completed	33 (Checkdam-9,Perco.tank-4,Gabion str-1and RTRWH-19)
Piezometers	NIL
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>There is a marked rise in water level in the pre monsoon period in all the three piezometers, ranging from 5.6 m to 2.5 m from the pre project to the post project period. Similarly, the rise is also recorded in post monsoon water levels for the three piezometers, ranging between 0.8 m to 2.0 m. Minimum average depths to water levels, as recorded from all the ten (10) observation data points during pre-monsoon periods i.e. June, '12, May, '13 and May, '14 are 2.9 m bgl, 3.2 m bgl and 1.9 m bgl respectively, whereas the maximum average depth to water level during May,12, May,13 and May,14 are 29.2 m bgl, 11.6 m bgl, and 10.1 m bgl, respectively, clearly indicating sudden rise during the first year due to prolonged wet periods on account of 57 rainy days and there after steady rising trend in the water table</i> <i>The cumulative yield of the ten bore wells for the pre project period i.e May, 2012 was 2.9 lakhs liters per day. On completion of rain water harvesting structures, due to artificial recharge to ground water and due to aquifer saturation, the yield increased to 3.66 lakhs liters/day during 2012-13 which got further enhanced to 5.60 lakhs liters/day during the water year 2013-14,</i>

	<i>registering almost double the quantity in the yield of the bore wells by the post project period</i> <i>Huge area of 260 ha of the campus had vegetation cover but had suffered for lack of moisture during the summer months. However, after the completion of the artificial recharge structures, along with ground water recharge, soil moisture also increased considerably. This has immensely benefitted the existing trees cover</i>
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PHOTOS AFTER JUNE 15 RAINS



Behind SDCE CD.JPG

PHOTOS AFTER JUNE 15 RAINS



Near new Women's Hostel.JPG



Behind SDCE PT.JPG



Near Voluntary Hostel PT.JPG

Rainwater Harvesting in the premises of Kakatiya University, Warangal, Telangana



Behind filter beds



Behind Humanities Building CD

Rainwater Harvesting in the premises of Kakatiya University, Warangal, Telangana

Name of the scheme	Rainwater Harvesting in the premises of Jawaharlal Nehru Technological University(JNTU), Kukatpaali Hyderabad, Ranga Reddy dist, Telangana.
Implementing Agency	Jawaharlal Nehru Technological University(JNTU), Govt of Telangana
Block/Mandal/Taluk	Kukatpalli Block
Category of block/mandal/taluk	Safe
District	Ranga Reddy District
Approved Cost (in lakh)	39.90
Fund Utilised (in lakh)	39.90
Type & No. of Structures	1 (Rech. Pond with shafts and associated structures)
Structures completed	1
Piezometers	3
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>The total quantity of rainwater harvested and recharged through about 13,500 cu.m In order to assess the impact of rainwater harvesting structures three Piezometers each with 30.0 m depth were constructed based on the watershed areas. The perusal of the hydrographs indicates that, in general water level is showing rising trend.</i>



RWH structure with two bore well located near new IST building Jawaharlal Nehru Technological University(JNTU),Kukatpaali Hyderabad, Ranga Reddy dist, Telangana



Open pond along with two recharge wells at Jawaharlal Nehru Technological University(JNTU), Kukatpaali Hyderabad, Ranga Reddy dist, Telangana

Uttar Pradesh

No. of AR Projects Implemented : 4

No. of Projects Impact Assessment received : 1

Name of the scheme	Artificial Recharge to Groundwater in Sataon Block of Rae Bareli District. Uttar Pradesh
Implementing Agency	Minor Irrigation Dept, Govt. of Uttar Pradesh
Block/Mandal/Taluk	Sataon Block
Category of block/mandal/taluk	Safe
District	Rae Bareli District
Approved Cost (in lakh)	720.063
Fund Utilised (in lakh)	720.063
Type & No. of Structures	28 (Checkdam-16, Rech.wells-12 with associated structures)
Structures completed	28
Piezometers	20
Type & No. of Structures dropped	NIL
Impact of the scheme	<i>During Nov'11 rise in water levels is observed in all the 24 stations analysed with respect to water levels of Nov'10. Five stations show a rise of 0 to 0.20 m, eight stations show rise in the range of 0.20 to 0.40 m and three stations show rise between 0.40 & 0.60 m. eight monitoring station show rise of more than 0.80 m. The water level data of Mar'12 & Mar'11 has also been compared and results indicate a rise in water levels in 18 stations out of 23 stations analyzed (about 78%). Out of these 18 stations 16 stations show a rise from 0.05 to 0.45 m and 2 stations show rise in the range of 0.80 to 1.00 m.</i> <i>It is observed that after about one and a half year of project implementation there is improvement in water levels indicated by a rise of about 0.20 m in general. Thus considering an area of 240 sq.km of the block & 0.10 as specific yield of the formation, there is about 4.8 MCM built up of ground water resource.</i>



CHECK DAM AT SATAON BLOCK, DISTRICT RAEBARELI, UP

West Bengal

No. of AR Projects Implemented : 1

Name of the scheme	Artificial Recharge in the Blocks of Nalhati-I and Murarai-I of Birbhum District. West Bengal
Implementing Agency	Minor Irrigation Dept, Govt. of Uttar Pradesh
Block/Mandal/Taluk	Nalhati-I and Murarai-I blocks
Category of block/mandal/taluk	Semi Critical
District	Birbhum District
Approved Cost (in lakh)	111.091
Fund Utilised (in lakh)	111.091
Type & No. of Structures	30 (Nalabund-20, SSD-2, Gully Plug-5, DW-1,BW-1, RTRWH-1
Structures completed	29 (One structure was dropped due to local reason)
Piezometers	Nil
Type & No. of Structures dropped	1(RTRWH)
Impact of the scheme	<i>15 nos. and 20 nos. P.Tubes are installed in the Murari-I and Nalhati-I block respectively near the location of the structures constructed, for the monitoring of ground water level.</i> <i>Due to the structures constructed, the groundwater level within the area has been increased. The value ranges from 0.531 m to 2.566 m with an average of 1.521 m in pre monsoon and from 3.957 m to 4.942 m with an average of 4.643 m in post monsoon period.</i>



Nala Bundh at Chandapara Mouza, Murarai-I Block, Birbhum District



Sub-Surface Dyke at Barsor Mouza, Nalhati-I Block, Birbhum District



Gully Plug at Sultanpur Mouza, Nalhati-I Block, Birbhum District



Roof Top Rain Water Harvesting Structure at Banior G.P., Nalhati-I Block, of Birbhum District