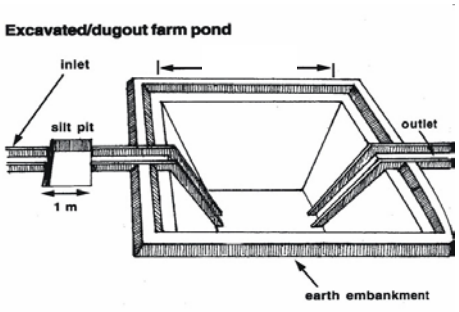
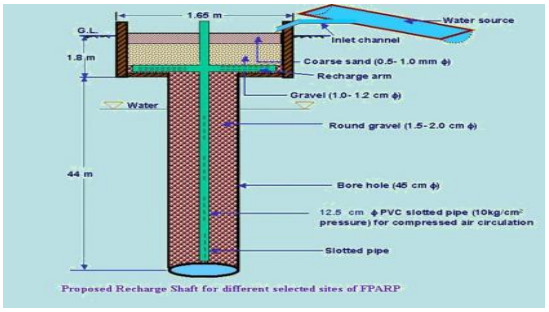
CENTRAL GROUND WATER BOARD

MINISTRY OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION
GOVERNMENT OF INDIA





ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF SAHADA (SAHARA) BLOCK, DISTRICT BHILWARA,

Western Region, Jaipur
April 2016

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF SAHADA (SAHARA) BLOCK, DISTRICT BHILWARA

Plan at a Glance

1.	**Area of the Sahada Block**	**653.90 sq.km.**
2.	**Area identified for Artificial Recharge**	**634.69 sq km**
3.	**Dynamic Ground Water Resources (as on 31.03.2011)**	
	Net Ground Water Availability	**21.8959 MCM**
	Annual Ground Water Draft	**29.3122 MCM**
	Stage of Ground Water Development	**133.87%**
4.	**Volume of water to be harnessed** **Volume of water available for recharge** **Volume of water available for conservation by other interventions**	**4.8253 MCM** **4.8253 MCM** **-**
5.	**Volume of unsaturated aquifer zone available for recharge**	**104.248 MCM**
6.	**Total number of structures to be proposed**	
	Recharge structures Existing village pond with recharge shaft/ well Percolation Tank	**Numbers** **154 shafts in 154 Nos. of existing village ponds** **1 Nos.**
	Expected Annual GW recharge	**3.37 MCM**
	Provision for supplemental irrigation, thus reducing GW withdrawal for irrigation	**-**
	Total recharge/ saving of ground water	**3.37 MCM**
7.	**Estimated Cost** Artificial Recharge Plan Piezometer construction Operation and maintenance	**5.034 crore** 4.404crore 0.39 crore 0.24 crore

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF SAHADA (SAHARA) BLOCK, DISTRICT BHILWARA

INTRODUCTION

The demand of fresh water for agriculture, drinking and industrial uses etc. has significantly increased due to population growth and socio-economic development. As surface water resources in the State of Rajasthan are meagre, the dependability on ground water resources in the State has increased substantially. This has resulted in over exploitation of ground water resources vis a vis depletion of ground water levels in various parts of the State.

The **Sahada (Sahara) Block, district Bhilwara** is one of the over exploited blocks of Rajasthan and is under severe stress, as evident from the stage of ground water development, which has attained an alarming level of **133.87%.** In view of over exploitation of ground water resources in the block, ground water resources in the area are under continuous depletion. Thus there is urgent need for taking up suitable water management interventions based on integrated approach, which on one hand includes augmentation of ground water resources through appropriate techniques, and on the other hand requires the adoption of suitable water conservation measures, such as ensuring water use efficiency through creation of additional water storage facility, maintenance/ renovation of existing water bodies etc. Water awareness and capacity building of the stakeholders are also the important attributes of water management interventions as envisaged in the National Water Policy.

Artificial recharge to ground water is one of the most efficient, scientifically proven and cost effective technology to mitigate the problems of over exploitation of ground water resources. The technology serves as a means for restoring the depleted ground water storage, ameliorate the ground water quality problems and also enhance the sustainability of wells in the affected areas. A detailed knowledge of geology, hydrogeology, land use pattern, geomorphology and hydro-meteorological features are however, essential for selection of appropriate artificial recharge techniques as well as design and sites of ground water recharge structures.

As per directions of Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India and in pursuance to letter no 16-24/M(SML)/CGWB/ARP- OE Blocks/2015-6957, dated 13.7.2015 & 3.8.2015 & letter no 39(43)/TC/CHN/CGWB/2015-7929,dated 4.9.2015 from Central Headquarters, Central Ground Water Board, **the preparation of Artificial Recharge and Rainwater harvesting Plan for the Over exploited blocks in the State of Rajasthan has been taken up** on priority by the Western Region, Central Ground Water Board, Jaipur. Each Plan discusses the broad framework of ground water situation in the block, status of water availability (both surface and ground water), identification of feasible areas for interventions, feasibility of Artificial recharge and other water conservation structures, their design considerations, numbers and cost estimates. The expected outcomes of the proposed interventions have also been elucidated in the report

The GIS layers used in the Plan include administrative (upto village level), Hydrogeology, Depth to Water level (pre and post monsoon), geomorphic, drainage, water bodies and the map of tentative locations of proposed interventions.

Methodology:

As per Ground Water Department, Government of Rajasthan direction the basin wise availability of surplus run off is calculated after taking into account 75 % dependability on the rain water for all uses. In furtherance, the sub basins with surplus run off available for recharge were taken into consideration. The block area falling in particular sub basin was taken into account and a proportionate area of the sub-basin draining the block was calculated. Based on this area of sub-basin draining the block, proportionate surplus run off, in the block by the sub basin, for recharge was calculated. Thus was calculated the final amount of surplus run off available for recharge in particular block by one particular sub-basin. The available run off was considered for Recharge through Recharge Shaft (@ 0.03 MCM) and Percolation tank (@ 0.2 MCM). If after allocating water for Recharge through Recharge Shaft, large amount of surface run off was left then the Water conservation through Farm Ponds, along with recharge through Percolation Tanks, was also taken into account. Besides the available run off the Average Water Level for the time span of ten years (Nov., 2005 to Nov. 2014) and the Decadal Water Level trend (Nov., 2005 to Nov. 2014) were also taken into account. The blocks showing average water level more than 5 m bgl and declining water level trend were considered suitable for Artificial Recharge Plan.

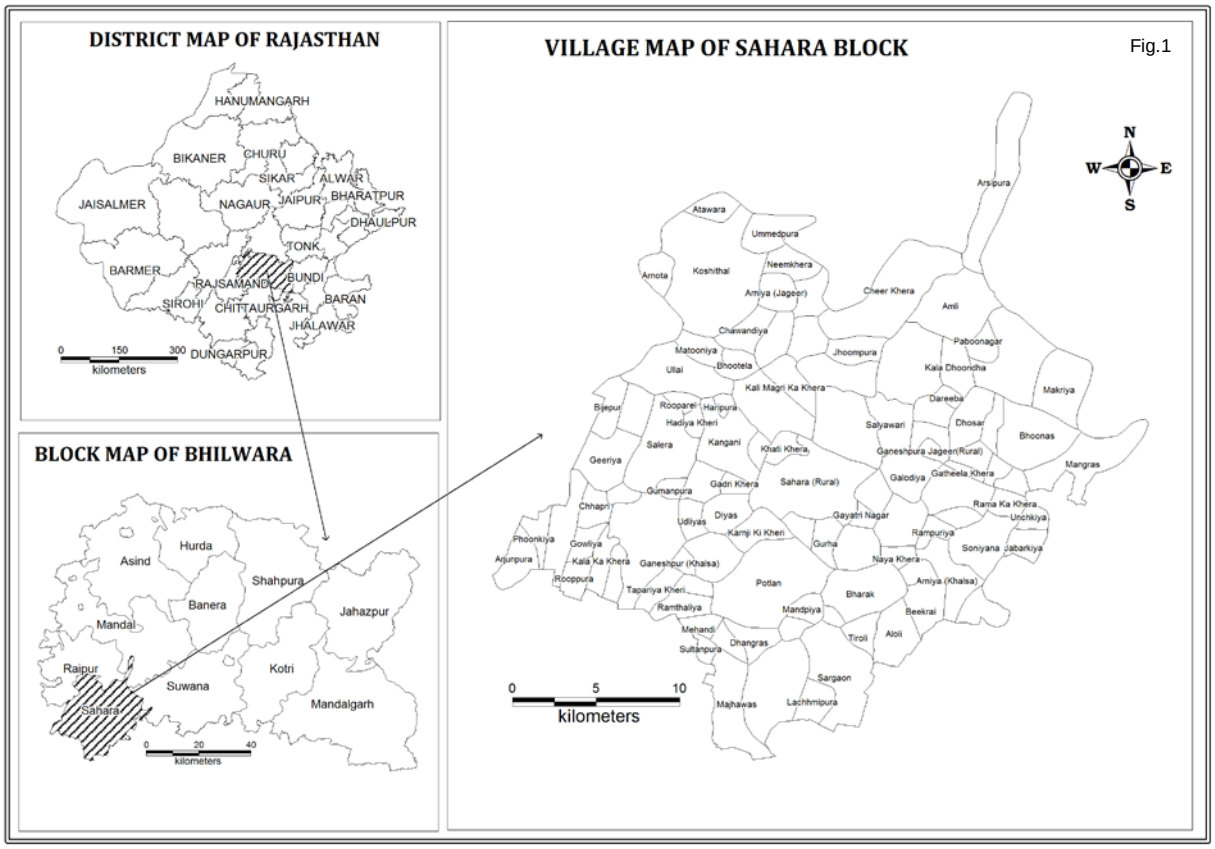
Location of the block

Sahara Block of Bhilwara district falls under Over-Exploited category. It covers an area of 653.90 sq. km. and falls in southwestern part of Bhilwara district. It is located between North latitudes 25°03’ & 25°24’ and East longitudes 74°04’ & 75°27’. The total rural population of the Block is 116309 persons as per the 2011 census. It is comprised of 57267 males and 59042 females. Location map is shown in **fig 1**.

Source wise Irrigated Area

Out of total area of 653.90 sq.km., an area of 32.11 (4.91%) falls under irrigation. An area of 1.38 sq. km. is irrigated through canals & another 7.25 sq.km. of area is irrigated through ponds. The wells irrigate total 12.66 sq. km. area in this Block and 10.82 sq.km. area is irrigated through other sources.

Fig: 1



Physiography & Drainage

Physiographically, the block is characterized by presence of buried pediments of denudation origin. The minimum and maximum elevation of Block is 442.1 m and 636.5 m, respectively. The map showing various geomorphic units is presented in **fig 2**.

There is no perennial river flowing in this Block. It is drained by ephemeral Kothari river in northern parts. The entire block falls under Banas river basin. The map showing drainage and water bodies in the Sahada block are shown in **fig 3**.

Fig: 2

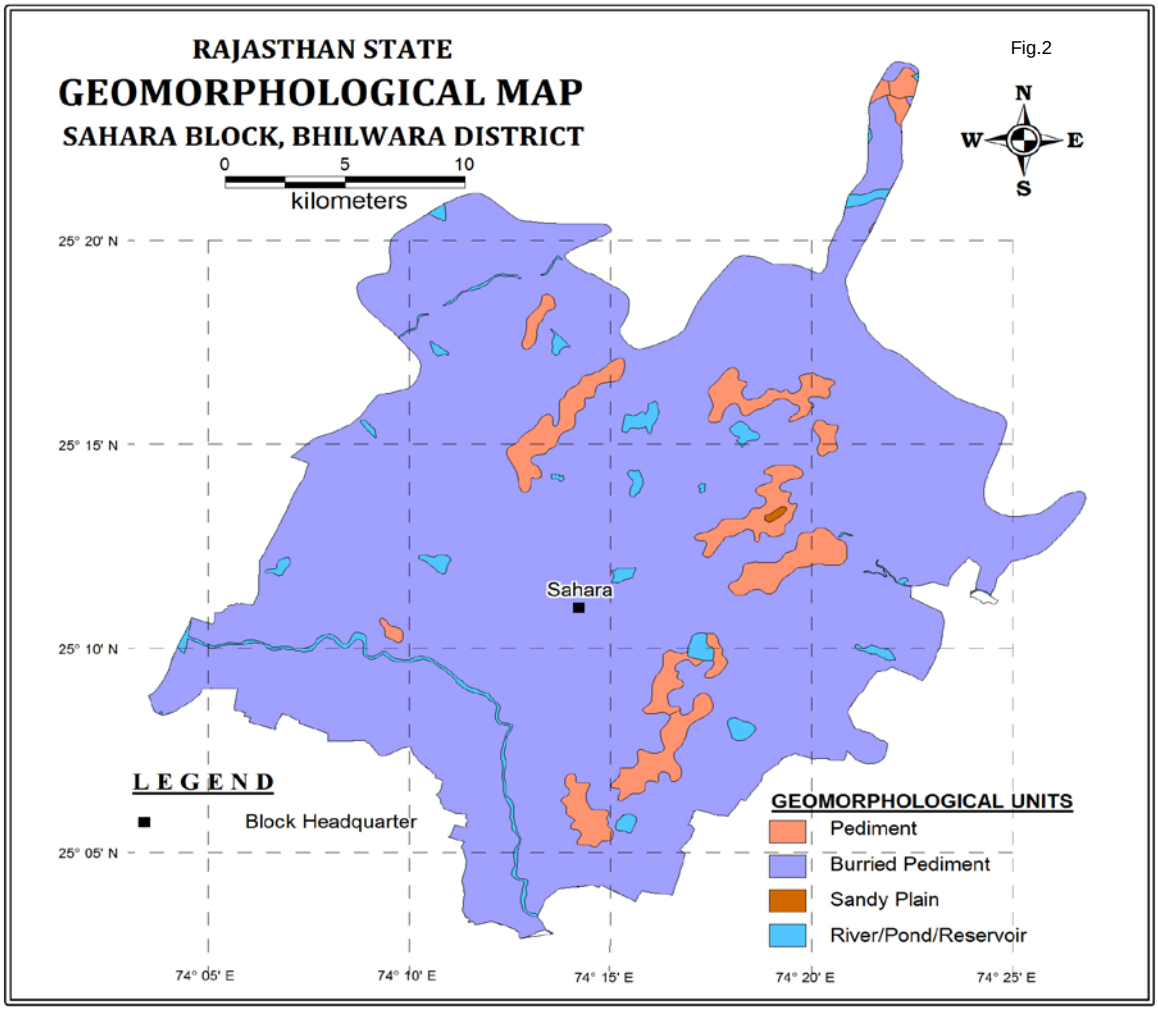
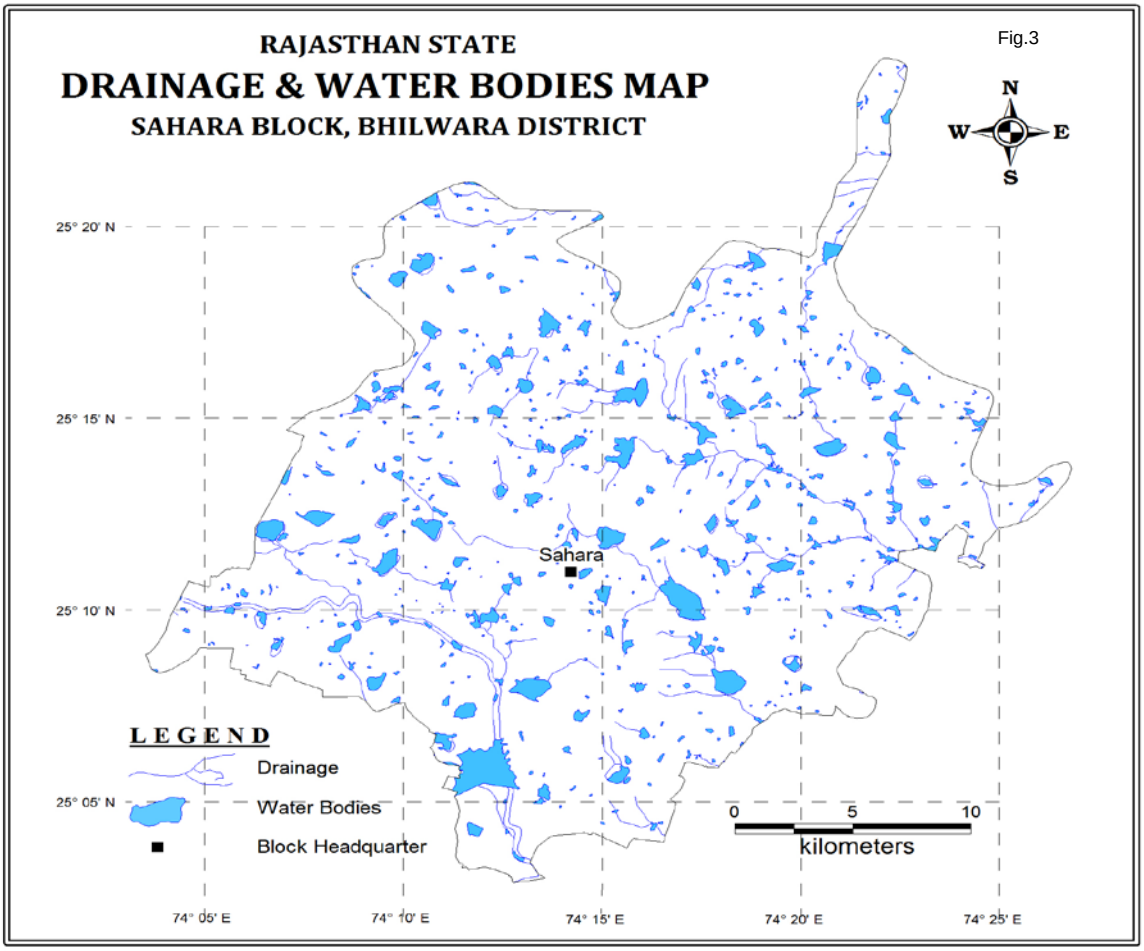

RAJASTHAN STATE
GEOMORPHOLOGICAL MAP
SAHARA BLOCK, BHILWARA DISTRICT
Fig.2
0 5 10
kilometers
N
W E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Block Headquarter
GEOMORPHOLOGICAL UNITS
Pediment
Burried Pediment
Sandy Plain
River/Pond/Reservoir
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Fig: 3



Rainfall

The climate of the block is semi arid. The Normal annual rainfall of block is 565.70 mm (IMD, 1901-70). The available data of rainfall indicates that larger part of annual rainfall is received through SW monsoon during July to September.

Hydrogeology of the Area

The major water bearing formations in the Block are gneiss and schist of Bhilwara Supergroup, overlain by thin cover of alluvium. Out of total geographical area of 653.90 Sq. Km, an area of 634.69 sq. km. (97.06%) forms aquifer system (potential zone) in the block and remaining 19.81 sq. km.(2.94%) area is represented by hills. Ground water occurs under unconfined to semi-confined condition. Extent, size, opening and inter-connection of joints, fissures and other plains of structural weakness control occurrence & movement of ground water. Muscovite schist often grades into gneiss. These have well-developed foliation and irregular joints and are intruded by granite, pegmatite and quartz veins. The contact between these intrusive and schist provides good channel for ground water circulation. In general yield of wells tapping Gneiss & Schist ranges from 0.29 to 0.58 lps.

Ground Water Level

As per Average decadal depth to water level (from November, 2005 to November, 2014), the block majorly falls in water level range 5-10 and 10-20 m bgl range. **(Fig 4)**

The average decadal depth to water level is 16.27 m bgl for Pre monsoon & 10.11 m bgl for Post monsoon. In general, the depth to water level is between 5 & 10 and 10 & 20 m bgl in major part of Block. The Map showing Depth to water level for May, 2014 and November, 2014 is shown in **Fig 5 & 6.**

Water Level Trend:

All the hydrographs are showing declining water level trends over last 10 years. Water level trend shows average decline of 0.28 m/year during pre monsoon and 0.01 m/year during post monsoon.

As per the Decadal Water level trend (from November, 2005 to November, 2014), the declining trend is visible in the block. The fall in the range of -1 to 0 and 0 to 1 m/ year in ground water level is prevalent in the block. The map of Decadal Water Level Trend is shown in **fig. 7**

Fig: 4

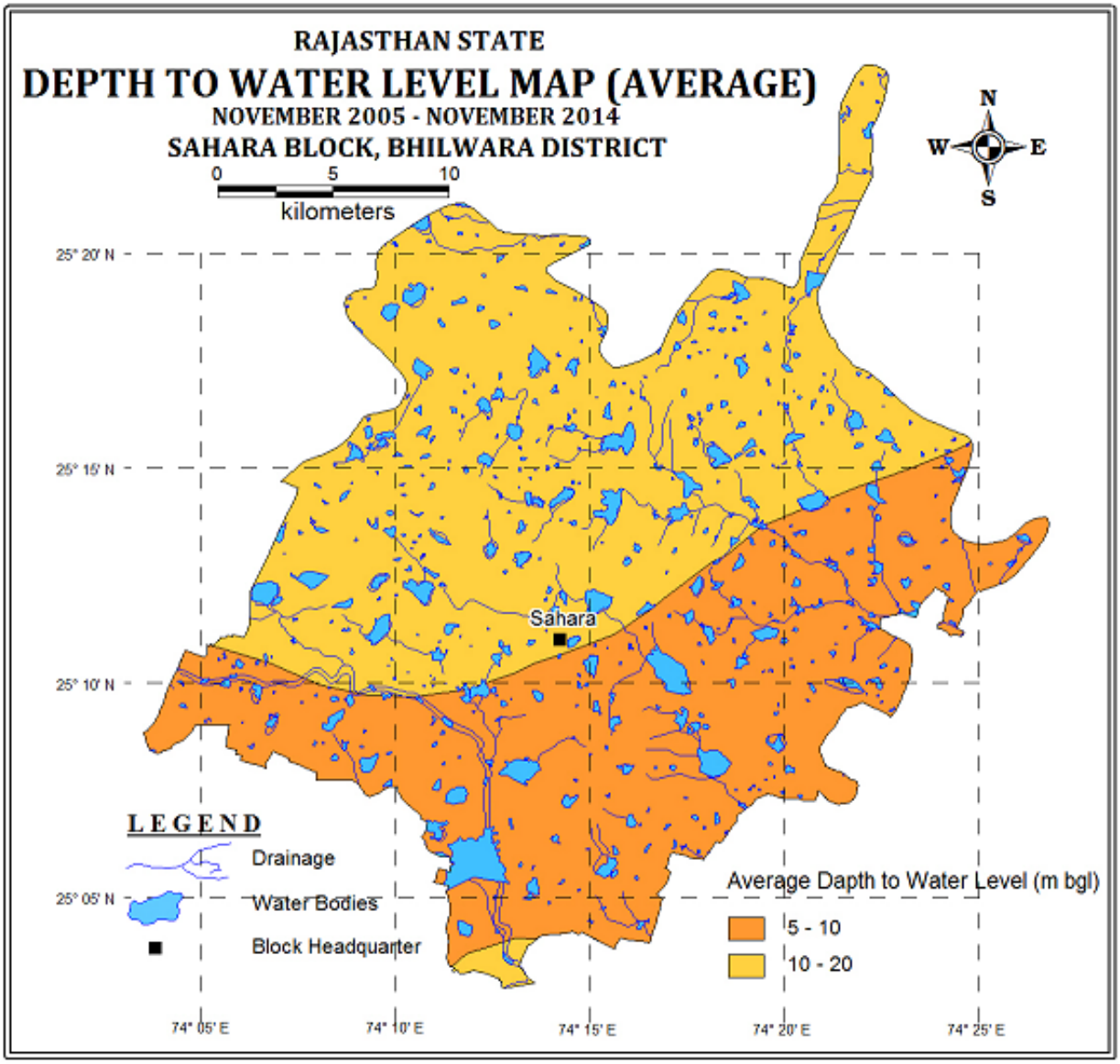

RAJASTHAN STATE
DEPTH TO WATER LEVEL MAP (AVERAGE)
NOVEMBER 2005 - NOVEMBER 2014
SAHARA BLOCK, BHILWARA DISTRICT
0 5 10
kilometers
N
W E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Drainage
Water Bodies
Block Headquarter
Average Dapth to Water Level (m bgl)
5 - 10
10 - 20
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Fig: 5

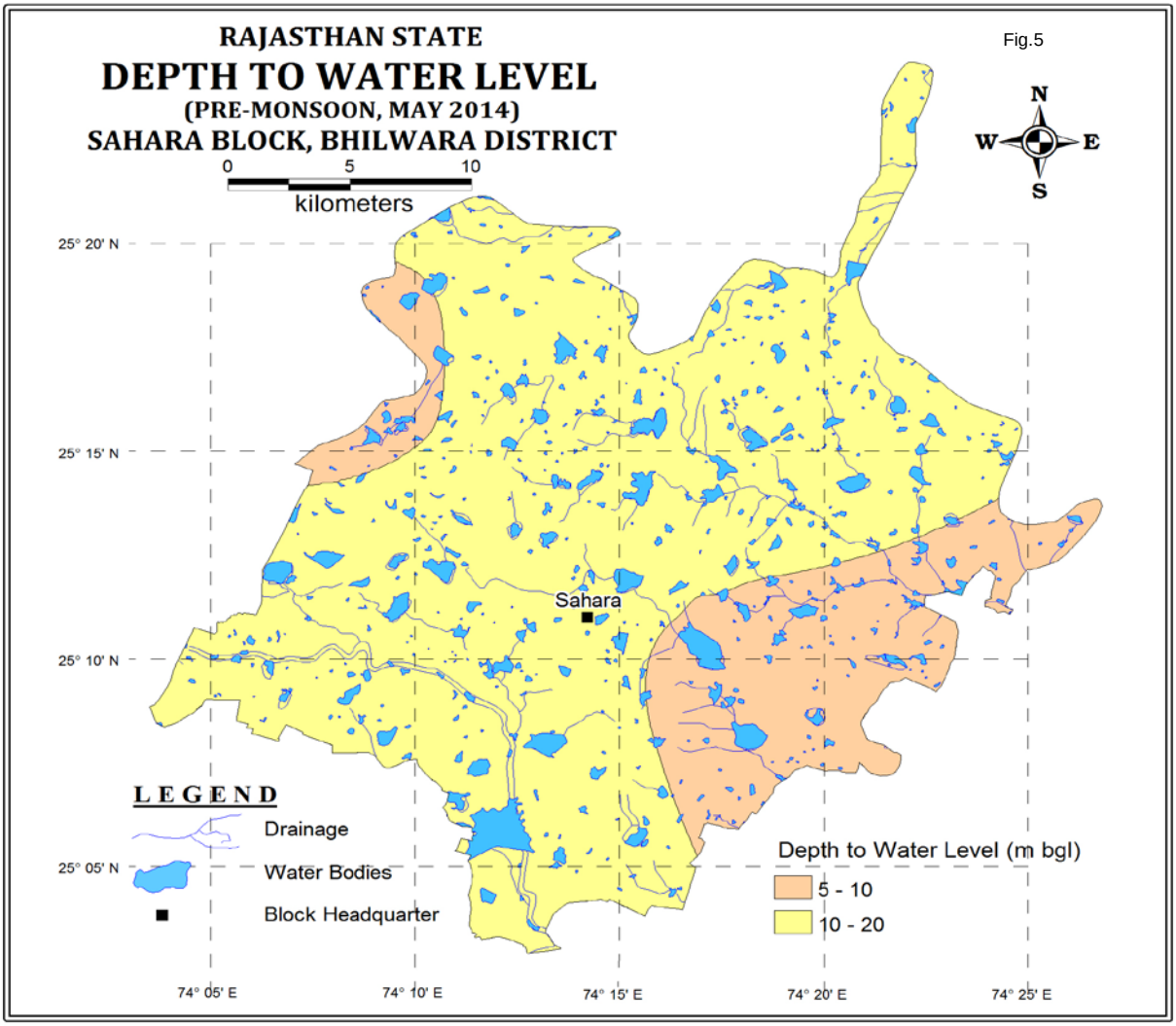

RAJASTHAN STATE
DEPTH TO WATER LEVEL
(PRE-MONSOON, MAY 2014)
SAHARA BLOCK, BHILWARA DISTRICT
Fig.5
0 5 10
kilometers
N
W E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Drainage
Water Bodies
Block Headquarter
Depth to Water Level (m bgl)
5 - 10
10 - 20
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Fig: 6

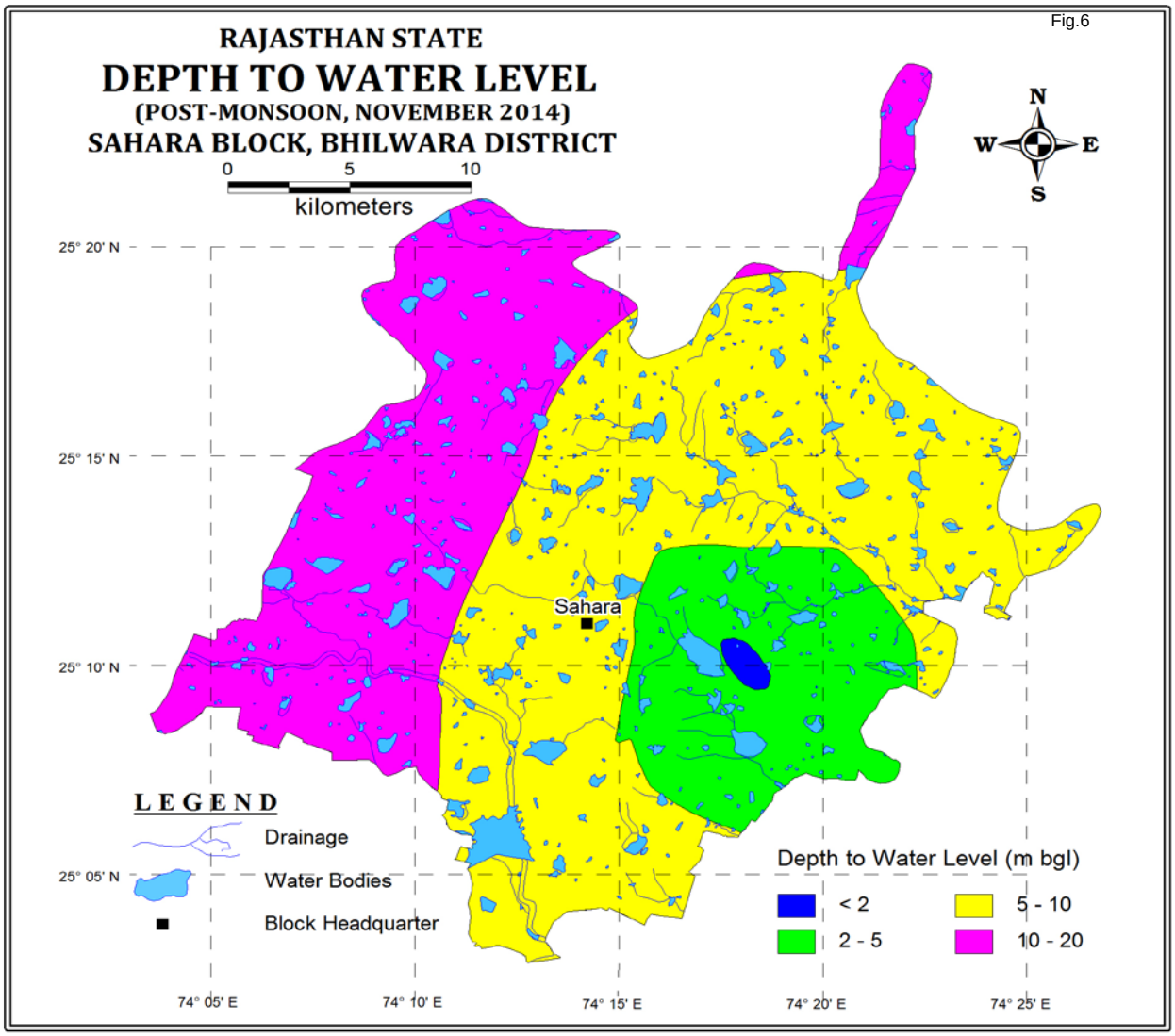
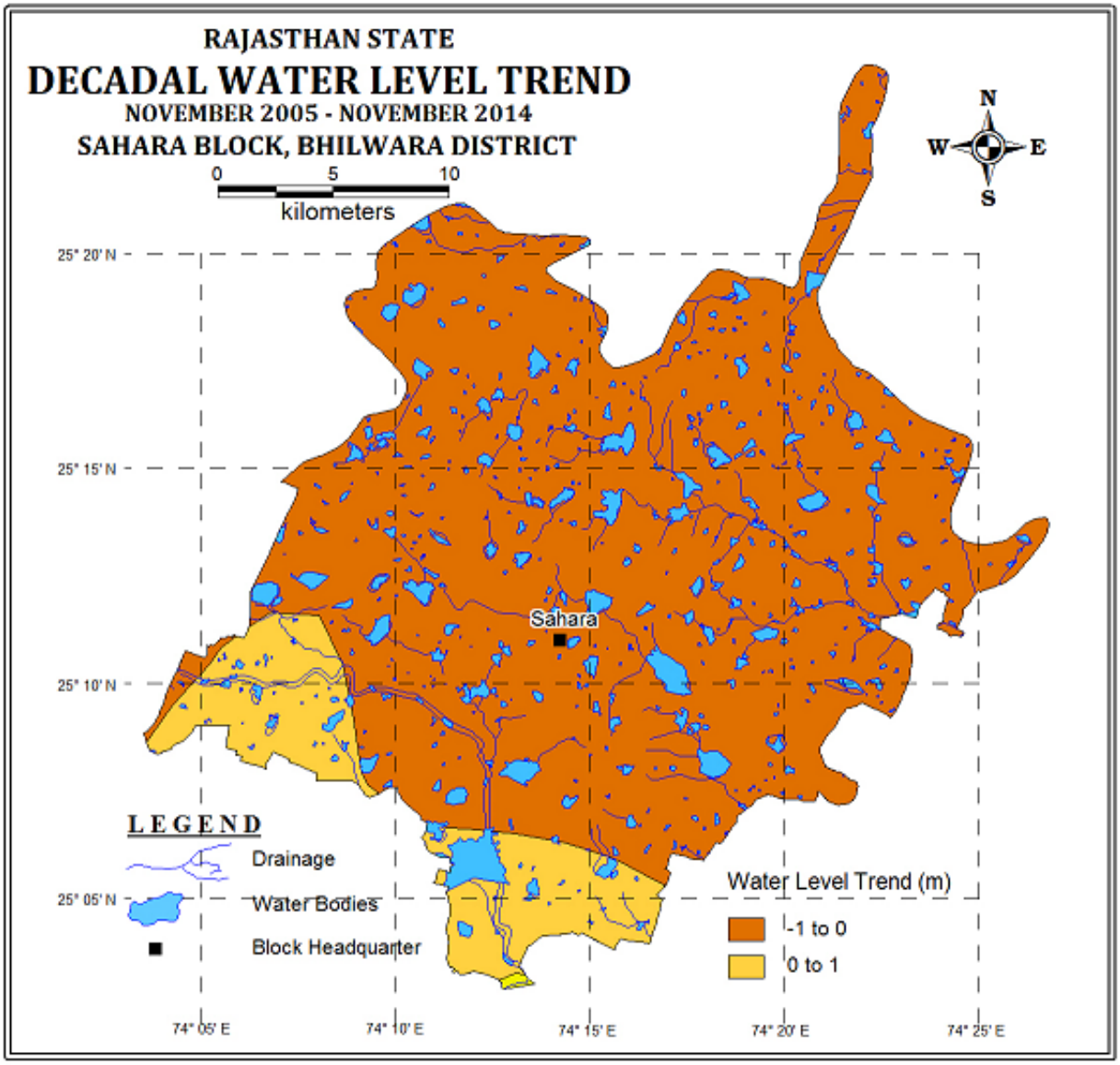


Fig.6
RAJASTHAN STATE
DEPTH TO WATER LEVEL
(POST-MONSOON, NOVEMBER 2014)
SAHARA BLOCK, BHILWARA DISTRICT
0 5 10
kilometers
N
W E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Drainage
Water Bodies
Block Headquarter
Depth to Water Level (m bgl)
< 2
2 - 5
5 - 10
10 - 20
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Fig: 7


RAJASTHAN STATE
DECADAL WATER LEVEL TREND
NOVEMBER 2005 - NOVEMBER 2014
SAHARA BLOCK, BHILWARA DISTRICT
0 5 10
kilometers
N
W E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Drainage
Water Bodies
Block Headquarter
Water Level Trend (m)
-1 to 0
0 to 1
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Subsurface Hydrogeology

As inferred from borehole data of the Sahada Block; Schist, Phyllite & Gneiss form the aquifers. However, the ground water in these only occurs in shallow weathered parts or fractures due to absence of primary porosity. The quality of ground water in the block is affected by high salinity & fluoride contamination.

Dynamic Ground Water Resource

The status of ground water resources of the block is presented in table 1. The annual Net Ground Water Availability in the block is 2189.59 ham and Annual Ground water draft is 2931.23 ham. Stage of Ground water development has reached 133.87%.

Table 1: Ground Water Availability, Utilization and Stage of Development Sahada Block, Bhilwara District (As on 31.3.2011)

Natural Discharge During Non Monsoon Period	233.65 ham
Net Annual Ground Water Availability	2189.59 ham
Annual Ground Water Draft	2931.23 ham
Net Ground water Availability for Future Irrigation Use	Nil
Stage of Ground Water Development	133.87%
Source: Ground Water Resource Assessment 31.03.2011	

Need for artificial recharge and water conservation plan

The present artificial recharge and water conservation Plan aims to mitigate the problems of continuous decline in water levels over the area through techniques of artificial recharge utilizing surplus rainwater based on scientific manner for optimal results. The broad scope of the recharge plan is as follows:

- Establishing efficacy of integrated approach through various artificial recharge and water conservation techniques. Intervention is proposed in cluster mode basis wherever feasible to have a better impact.
- Enhancing water use efficiency for controlling excessive ground water draft, especially for irrigation purposes.
- Ensuring sustainability of ground water abstraction structures and improvement in quality of ground water.

Surface water availability

As per the studies carried out by Water Resources Department, Govt of Rajasthan there is hardly any surplus water available for further development at 75% dependability. However, after taking into account the availability of source water in the basins of Rivers flowing in the State proportionate amount of surplus runoff available in particular block by particular sub basin was calculated.

Accordingly about 4.8253 MCM has been considered for recharge plan in the block. Optimum utilization of rainwater runoff depends on availability of land, feasible conditions, etc. Surface water availability, allocation and number of structures are presented in table 2.

Table 2: Source water for artificial recharge and number of recharge structure

District	District code	Block	Block code	Area of Block (Sq.km.)	Potential area suitable for recharge (Sq.km.)	Type of Aquifer	Area feasible for artificial recharge (Sq km)	Sp Yield
BHILWARA	RJ07	**SAHADA**	RJ0708	653.900	634.690	hard rock	634.690	0.015

Table 2 (contd): Source water for artificial recharge and number of recharge structure

Average DTW (mbgl) NOV 2013	Thickness of unsaturated zone 3 m below ground level (m)	Volume of sub surface storage space available for artificial recharge (MCM)	Sub Basin	Surplus available in the block (in Mm3)	Surplus water used in Recharge Shaft (RS)	No. of RS (0.03 MCM/RS)	Remaining Surplus water for Percolation tank (PT)	No. of PT (0.2 MCM/ PT)
13.950	10.950	104.248	Banas	4.8253	4.62	154	0.21	1

Feasible Artificial Recharge and water conservation structures

A wide spectrum of techniques is in vougue, which are being implemented to recharge the ground water reservoir, conserve the utilizable rainfall and enhance the water use efficiency. Based on prevailing field conditions, out of total block area of 653.90 sq km practically 634.69 sq km area is feasible for implementing recharge measures. Based on available information about the area such as ground water scenario, hydrogeology, hydrology, topography, rainfall pattern, drainage, soil cover, utilizable rainfall etc. scope for various interventions has been studied and assessment of suitable areas, tentative design and costs of structures has been worked out in the present plan.

Identification of feasible areas

Sahada block is having ground water level between 5 to 10 and 10 & 20m below ground level and as per dynamic ground water resource estimation, the block is over exploited with stage of ground water development at 133.87%. The Sahada block is feasible for

recharge due to presence of permeable zone above water table, favorable land slope and availability of water from rainfall.

Generally the Artificial recharge structures suitable in this type of area are Check dams/ Anicuts/ Percolation tanks and Recharge Shafts/ Recharge wells. Since the ground water levels are quite deep in the block, the structures like ani-cuts and Check dams are not suitable and also their construction is regulated. Considering this aspect the proposal for Recharge Shaft/ Recharge wells and have been firmed up in the present Plan are the most suitable structures in Sahada block. In view of the availability of number of ponds in the block, percolation tanks are also not found feasible.

Details of Ground Water Recharge Measures

Existing Village Pond with recharge shaft/wells

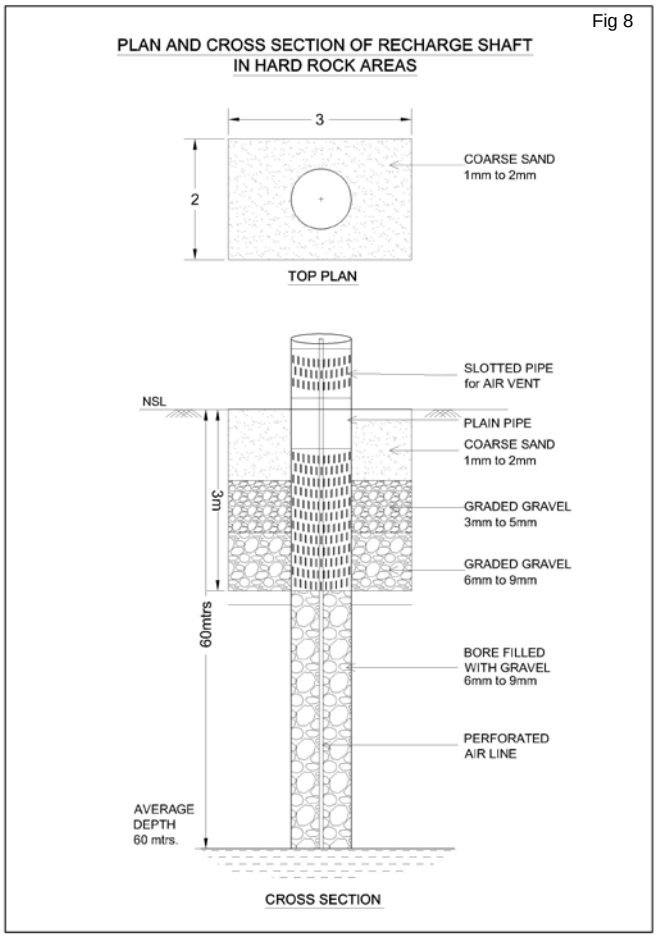
Almost all the villages in the State of Rajasthan have one or two village ponds & other ponds. With time, these ponds get silted & hardly any water percolates downward. Also, any excess water coming into the pond goes away as a run off due to limited storage capacity. This surplus runoff can very well be utilized for recharging the ground water and also for enhancing conservation of water that can be further used for irrigation, thereby saving ground water withdrawal. Since natural recharge from these ponds is limited due to siltation and ground water levels are deep, the most effective ground water structure considered under the Plan is Recharge Shaft/ Recharge well constructed within the pond itself.

The above mentioned recharge well has been designed in a manner that maximum surplus water would likely to be utilized for recharge as well as sufficient water is retained in the pond for local use.

The model design of recharge well has been worked out in consultation with Ground Water Department, Government of Rajasthan and presented in Fig 8. The major features required are:

1. The well should have sufficient diameter for recharge- 10 to 12 inch diameter well with bottom screen/ opening just above the highest ground water level.
2. The well should have screen/ opening at the top, which should be at least 1.5m above the bed level of the pond.
3. The upper opening should be surrounded with filter pack comprising graded filter media of medium, coarse sand & gravel, so that the Recharge well does not get silted.

Fig 8



The opening for inflow to the well has been proposed at 1.5m above Bed level of pond. This is necessary to ensure that the pond retains sufficient water for use by local consumers. However, this may necessitate further deepening of pond itself so that the pond is 3-4 m deep. A Single well as discussed above would be suitable for a pond upto area of about 5ha. Therefore, more number of such Recharge wells is envisaged for larger ponds.

Tentative Locations of Recharge shafts:

The tentative location of villages for construction of recharge shaft/well in existing village pond and their cost estimates are shown in Fig 9 and Table 3. The plan proposes construction of 154 recharges shafts/ wells in 154 identified existing village ponds at an estimated cost of 400.4 lacs. The block also has area with shallow water level (<10m), which is not recommended for artificial recharge.

Table 3: Tentative locations of village for village pond with recharge shaft

S.No.	Village	Long	Lat	Pond area (ha)	Formation	No of Shafts	Unit cost (Rs in lac)	Total cost (Rs in lac)
1.	Surat Singh Ka Khera	74.242	25.266	10.7438	Hard_rock	1	2.6	2.6
2.	Jhoompura	74.258	25.271	14.6799	Hard_rock	1	2.6	2.6

3.	Cheer Khera	74.260	25.283	4.7639	Hard_rock	1	2.6	2.6
4.	Cheer Khera	74.290	25.279	4.5131	Hard_rock	1	2.6	2.6
5.	Shivrati (Rural)	74.301	25.273	5.4804	Hard_rock	1	2.6	2.6
6.	Shivrati (Rural)	74.307	25.274	6.1051	Hard_rock	1	2.6	2.6
7.	Shivrati (Rural)	74.294	25.269	3.9380	Hard_rock	1	2.6	2.6
8.	Shivrati (Rural)	74.296	25.260	5.4351	Hard_rock	1	2.6	2.6
9.	Nandsa (Khalsa)	74.279	25.250	6.3643	Hard_rock	1	2.6	2.6
10.	Gangapur (M)	74.278	25.231	4.1668	Hard_rock	1	2.6	2.6
11.	Shivrati (Rural)	74.315	25.267	5.8488	Hard_rock	1	2.6	2.6
12.	Shivrati (Rural)	74.319	25.259	13.2636	Hard_rock	1	2.6	2.6
13.	Shivrati (Rural)	74.319	25.255	5.7729	Hard_rock	1	2.6	2.6
14.	Shivrati (Rural)	74.313	25.255	4.2578	Hard_rock	1	2.6	2.6
15.	Satdhoodiya	74.320	25.236	15.2973	Hard_rock	1	2.6	2.6
16.	Kala Dhoondha	74.336	25.262	22.9970	Hard_rock	1	2.6	2.6
17.	Amli	74.334	25.273	4.1609	Hard_rock	1	2.6	2.6
18.	Paboonagar	74.349	25.281	3.1441	Hard_rock	1	2.6	2.6
19.	Paboonagar	74.345	25.275	4.0178	Hard_rock	1	2.6	2.6
20.	Paboonagar	74.353	25.273	6.8404	Hard_rock	1	2.6	2.6
21.	Mahendragarh	74.377	25.279	9.0401	Hard_rock	1	2.6	2.6
22.	Mahendragarh	74.365	25.259	6.1546	Hard_rock	1	2.6	2.6
23.	Mahendragarh	74.373	25.250	14.5660	Hard_rock	1	2.6	2.6
24.	Mahendragarh	74.381	25.258	6.4311	Hard_rock	1	2.6	2.6
25.	Makriya	74.404	25.253	7.2826	Hard_rock	1	2.6	2.6
26.	Makriya	74.408	25.248	12.8285	Hard_rock	1	2.6	2.6
27.	Makriya	74.408	25.245	3.2439	Hard_rock	1	2.6	2.6
28.	Bhoonas	74.386	25.222	14.2281	Hard_rock	1	2.6	2.6
29.	Bhoonas	74.374	25.231	5.0387	Hard_rock	1	2.6	2.6
30.	Bhoonas	74.371	25.234	3.1931	Hard_rock	1	2.6	2.6
31.	Satdhoodiya	74.323	25.228	13.5602	Hard_rock	1	2.6	2.6
32.	Ullai	74.183	25.242	3.8313	Hard_rock	1	2.6	2.6
33.	Hadiya Kheri	74.176	25.232	3.2777	Hard_rock	1	2.6	2.6
34.	Salera	74.164	25.232	4.8759	Hard_rock	1	2.6	2.6
35.	Salera	74.158	25.227	7.2181	Hard_rock	1	2.6	2.6
36.	Jaisinghpura	74.144	25.239	8.1866	Hard_rock	1	2.6	2.6
37.	Salera	74.165	25.225	14.7549	Hard_rock	1	2.6	2.6
38.	Jaisinghpura	74.135	25.226	9.7525	Hard_rock	1	2.6	2.6
39.	Salera	74.159	25.207	22.9532	Hard_rock	1	2.6	2.6
40.	Salera	74.173	25.211	3.4062	Hard_rock	1	2.6	2.6
41.	Kangani	74.185	25.222	15.3065	Hard_rock	1	2.6	2.6
42.	Kangani	74.183	25.209	10.0759	Hard_rock	1	2.6	2.6
43.	Kangani	74.208	25.218	18.6172	Hard_rock	1	2.6	2.6
44.	Delana (Rural)	74.221	25.227	11.1254	Hard_rock	1	2.6	2.6
45.	Delana (Rural)	74.224	25.238	12.9202	Hard_rock	1	2.6	2.6
46.	Delana (Rural)	74.229	25.237	12.1007	Hard_rock	1	2.6	2.6

47.	Delana (Rural)	74.243	25.229	4.3370	Hard_rock	1	2.6	2.6
48.	Diyas	74.189	25.188	16.9020	Hard_rock	1	2.6	2.6
49.	Diyas	74.185	25.177	21.7085	Hard_rock	1	2.6	2.6
50.	Satliyas	74.197	25.160	20.6740	Hard_rock	1	2.6	2.6
51.	Karnji Ki Kheri	74.209	25.176	13.1437	Hard_rock	1	2.6	2.6
52.	Karnji Ki Kheri	74.214	25.179	11.1976	Hard_rock	1	2.6	2.6
53.	Diyas	74.212	25.182	3.5428	Hard_rock	1	2.6	2.6
54.	Sahara (Rural)	74.225	25.182	4.5905	Hard_rock	1	2.6	2.6
55.	Sahara (Rural)	74.235	25.195	8.5473	Hard_rock	1	2.6	2.6
56.	Sahara (Rural)	74.239	25.200	9.9264	Hard_rock	1	2.6	2.6
57.	Sahara (Rural)	74.233	25.203	4.5397	Hard_rock	1	2.6	2.6
58.	Sahara (Rural)	74.243	25.182	17.1295	Hard_rock	1	2.6	2.6
59.	Gurha Khera	74.245	25.166	3.1448	Hard_rock	1	2.6	2.6
60.	Potlan	74.228	25.162	14.1336	Hard_rock	1	2.6	2.6
61.	Karnji Ki Kheri	74.209	25.164	4.5363	Hard_rock	1	2.6	2.6
62.	Chhapri	74.124	25.183	3.0569	Hard_rock	1	2.6	2.6
63.	Chhapri	74.111	25.177	3.3573	Hard_rock	1	2.6	2.6
64.	Negarion Ka Khera	74.099	25.174	8.2135	Hard_rock	1	2.6	2.6
65.	Negarion Ka Khera	74.097	25.169	3.9946	Hard_rock	1	2.6	2.6
66.	Negarion Ka Khera	74.094	25.166	10.7348	Hard_rock	1	2.6	2.6
67.	Phoonkiya	74.084	25.167	4.3546	Hard_rock	1	2.6	2.6
68.	Arjunpura	74.076	25.158	3.7013	Hard_rock	1	2.6	2.6
69.	Gowliya	74.108	25.165	16.4359	Hard_rock	1	2.6	2.6
70.	Rooppura	74.113	25.151	12.8308	Hard_rock	1	2.6	2.6
71.	Khakhla	74.140	25.160	5.8617	Hard_rock	1	2.6	2.6
72.	Khakhla	74.147	25.160	11.5403	Hard_rock	1	2.6	2.6
73.	Khakhla	74.145	25.142	5.8878	Hard_rock	1	2.6	2.6
74.	Khakhla	74.140	25.138	5.8723	Hard_rock	1	2.6	2.6
75.	Khakhla	74.162	25.162	6.2041	Hard_rock	1	2.6	2.6
76.	Khakhla	74.156	25.165	3.5473	Hard_rock	1	2.6	2.6
77.	Satliyas	74.177	25.160	3.8716	Hard_rock	1	2.6	2.6
78.	Satliyas	74.189	25.151	11.2705	Hard_rock	1	2.6	2.6
79.	Potlan	74.213	25.159	4.6200	Hard_rock	1	2.6	2.6
80.	Potlan	74.207	25.136	5.7132	Hard_rock	1	2.6	2.6
81.	Potlan	74.205	25.129	3.7399	Hard_rock	1	2.6	2.6
82.	Ramthaliya	74.184	25.126	9.4507	Hard_rock	1	2.6	2.6
83.	Ramthaliya	74.164	25.128	6.2363	Hard_rock	1	2.6	2.6
84.	Ummedpura (Khalsa)	74.240	25.121	22.0238	Hard_rock	1	2.6	2.6
85.	Geeriya	74.117	25.224	16.1057	Hard_rock	1	2.6	2.6
86.	Geeriya	74.116	25.199	9.2749	Hard_rock	1	2.6	2.6
87.	Salera	74.145	25.197	18.5033	Hard_rock	1	2.6	2.6
88.	Khakhla	74.146	25.187	3.0733	Hard_rock	1	2.6	2.6
89.	Dhangras	74.216	25.113	3.6616	Hard_rock	1	2.6	2.6
90.	Surawas	74.235	25.106	7.0811	Hard_rock	1	2.6	2.6

91.	Sargaon	74.261	25.101	6.4078	Hard_rock	1	2.6	2.6
92.	Sargaon	74.261	25.092	5.4384	Hard_rock	1	2.6	2.6
93.	Surawas	74.224	25.084	6.7174	Hard_rock	1	2.6	2.6
94.	Majhawas	74.214	25.060	9.1887	Hard_rock	1	2.6	2.6
95.	Sargaon	74.272	25.073	7.0103	Hard_rock	1	2.6	2.6
96.	Sargaon	74.268	25.114	15.8860	Hard_rock	1	2.6	2.6
97.	Sargaon	74.275	25.102	4.4143	Hard_rock	1	2.6	2.6
98.	Tiroli	74.283	25.111	3.2233	Hard_rock	1	2.6	2.6
99.	Aloli	74.286	25.103	3.4344	Hard_rock	1	2.6	2.6
100.	Aloli	74.296	25.114	4.5030	Hard_rock	1	2.6	2.6
101.	Gurha	74.253	25.157	10.2620	Hard_rock	1	2.6	2.6
102.	Gurha	74.259	25.161	5.9146	Hard_rock	1	2.6	2.6
103.	Gurha	74.261	25.151	17.5877	Hard_rock	1	2.6	2.6
104.	Bharak	74.266	25.133	16.8275	Hard_rock	1	2.6	2.6
105.	Bharak	74.285	25.134	5.0237	Hard_rock	1	2.6	2.6
106.	Aloli	74.304	25.115	7.6272	Hard_rock	1	2.6	2.6
107.	Beekrai	74.315	25.119	5.5742	Hard_rock	1	2.6	2.6
108.	Arniya (Khalsa)	74.335	25.133	9.5622	Hard_rock	1	2.6	2.6
109.	Bharak	74.295	25.150	11.9384	Hard_rock	1	2.6	2.6
110.	Bharak	74.292	25.147	3.9544	Hard_rock	1	2.6	2.6
111.	Pichariya Khera	74.300	25.149	4.2010	Hard_rock	1	2.6	2.6
112.	Rampuriya	74.311	25.167	6.3032	Hard_rock	1	2.6	2.6
113.	Soniyana	74.346	25.164	4.7653	Hard_rock	1	2.6	2.6
114.	Soniyana	74.358	25.168	4.8947	Hard_rock	1	2.6	2.6
115.	Soniyana	74.362	25.166	22.9350	Hard_rock	1	2.6	2.6
116.	Mangras	74.389	25.193	22.6654	Hard_rock	1	2.6	2.6
117.	Mangras	74.403	25.204	5.3689	Hard_rock	1	2.6	2.6
118.	Mangras	74.430	25.212	5.2214	Hard_rock	1	2.6	2.6
119.	Mangras	74.437	25.223	12.1644	Hard_rock	1	2.6	2.6
120.	Mangras	74.386	25.205	12.7136	Hard_rock	1	2.6	2.6
121.	Bhoonas	74.374	25.211	18.6785	Hard_rock	1	2.6	2.6
122.	Bhoonas	74.372	25.206	7.3009	Hard_rock	1	2.6	2.6
123.	Bhoonas	74.371	25.218	7.2776	Hard_rock	1	2.6	2.6
124.	Bhoonas	74.361	25.217	4.0588	Hard_rock	1	2.6	2.6
125.	Baghpura	74.355	25.211	10.8709	Hard_rock	1	2.6	2.6
126.	Sakriya	74.361	25.198	3.1283	Hard_rock	1	2.6	2.6
127.	Rama Ka Khera	74.371	25.189	16.8612	Hard_rock	1	2.6	2.6
128.	Sakriya	74.371	25.193	3.8360	Hard_rock	1	2.6	2.6
129.	Soniyana	74.354	25.178	3.9627	Hard_rock	1	2.6	2.6
130.	Unchkiya	74.376	25.173	3.9982	Hard_rock	1	2.6	2.6
131.	Shriramnagar	74.334	25.183	4.7558	Hard_rock	1	2.6	2.6
132.	Lakhmaniyas	74.341	25.195	7.9400	Hard_rock	1	2.6	2.6
133.	Lakhmaniyas	74.337	25.197	4.3947	Hard_rock	1	2.6	2.6
134.	Gatheela Khera	74.339	25.205	9.2582	Hard_rock	1	2.6	2.6

135	Lakhmaniyas	74.348	25.196	5.5969	Hard_rock	1	2.6	2.6
136	Gatheela	74.339	25.216	5.7346	Hard_rock	1	2.6	2.6
137	Dhosar	74.335	25.220	4.0526	Hard_rock	1	2.6	2.6
138	Surajpura	74.328	25.221	3.9666	Hard_rock	1	2.6	2.6
139	Dhosar	74.342	25.225	4.4345	Hard_rock	1	2.6	2.6
140	Surajpura	74.319	25.222	4.0267	Hard_rock	1	2.6	2.6
141	Ganeshpura Jageer(Rural)	74.314	25.213	16.5365	Hard_rock	1	2.6	2.6
142	Surajpura	74.312	25.222	8.1923	Hard_rock	1	2.6	2.6
143	Galodiya	74.304	25.214	3.2190	Hard_rock	1	2.6	2.6
144	Galodiya	74.297	25.204	22.7373	Hard_rock	1	2.6	2.6
145	Nathji Ka Khera	74.293	25.192	15.5971	Hard_rock	1	2.6	2.6
146	Lakhola	74.301	25.186	24.2510	Hard_rock	1	2.6	2.6
147	Galodiya	74.314	25.198	14.2847	Hard_rock	1	2.6	2.6
148	Galodiya	74.305	25.205	10.0245	Hard_rock	1	2.6	2.6
149	Sahara (Rural)	74.273	25.196	17.0008	Hard_rock	1	2.6	2.6
150	Gangapur (M)	74.265	25.213	7.4510	Hard_rock	1	2.6	2.6
151	Gangapur (M)	74.271	25.219	7.8037	Hard_rock	1	2.6	2.6
152	Rampuriya	74.315	25.174	16.2381	Hard_rock	1	2.6	2.6
153	Rampuriya	74.316	25.177	3.3118	Hard_rock	1	2.6	2.6
154	Jabarkiya	74.373	25.167	13.3527	Hard_rock	1	2.6	2.6
						154		400.4

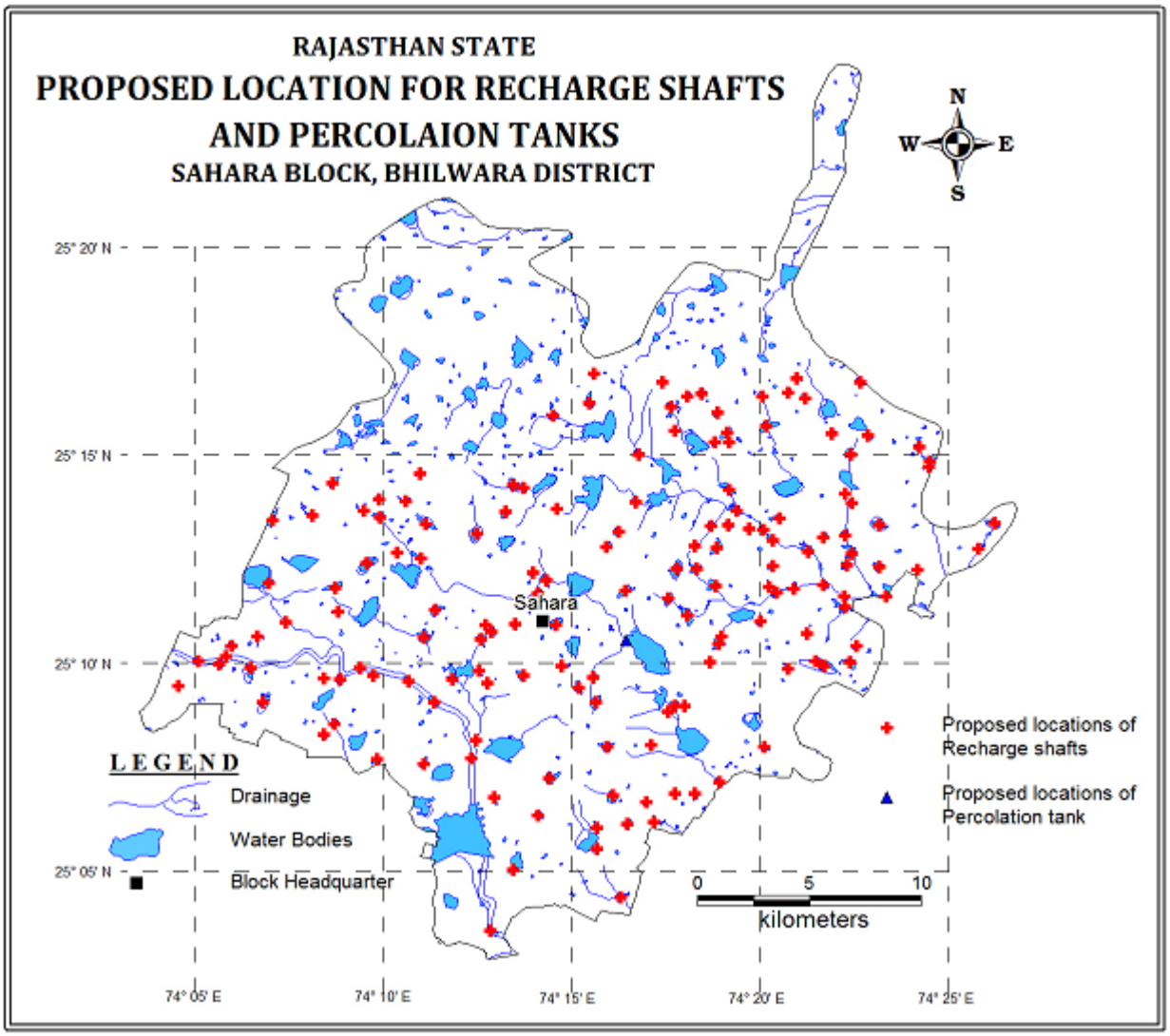
2. Percolation tanks

Percolation tanks are among the most common runoff harvesting structures in India. A percolation tank can be defined as an artificiallly created surface water body submerging a highly permeable land area so that the surface runoff is made percolate and recharge the ground water storage. These are not provide with sluices or outlests for discharging water from tank for irrigation or other purposes. They may, however, be provided with arrangements for spilling away the surplus water that may enter the tank so as to avoid over-topping of the tank bund. It is possible to have more than one percolation tank in a catchment if sufficient surplus runoff is available and the site characxterisitcs favor recahrge through such structures. Under the plan, 01 No. percolation tanks (200mx200mx1.5m) in the vicinity of respective villages. Location of percolation tanks is given in Fig 9 and Table 4.

Table 4: Tentative location of village proposed for percolation tank

SN	District	Block	Village	Longitude	Latitude
1.	Bhilwara	Sahara	Gayatri Nagar	74.274	25.176

Fig: 9


RAJASTHAN STATE
PROPOSED LOCATION FOR RECHARGE SHAFTS
AND PERCOLAION TANKS
SAHARA BLOCK, BHILWARA DISTRICT
N
W
E
S
25° 20' N
25° 15' N
25° 10' N
25° 05' N
Sahara
LEGEND
Drainage
Water Bodies
Block Headquarter
Proposed locations of Recharge shafts
Proposed locations of Percolation tank
0
5
10
kilometers
74° 05' E
74° 10' E
74° 15' E
74° 20' E
74° 25' E

Conservation Measures

As mentioned earlier the present Plan occurs on integrated approach of interventions, which includes both recharge measures as well as conservation of water while the recharge interventions have been discussed. The proposed conservation measures discussed below includes conservation of farm ponds, revival, repair of existing water bodies, etc.
However, no Farm Ponds are proposed for the block. Hence, the revival, repair of existing water bodies are discussed below:

A. Revival, repair of water bodies

The existing ponds and tanks in loose their storage capacity as well as the natural ground water recharge through these water bodies has also become negligible due to siltation and encroachment by farmers for agriculture purposes. There are several such villages where ponds/ tanks are in dilapidated condition. These existing village tanks, which are normally silted and damaged, can be modified to serve as recharge structure in case these are suitably located to serve as percolation tanks. Through desilting, coupled with providing proper waste weir, the village tanks can be converted into recharge structure.

Impact Assessment and Monitoring

Assessment of impact of the artificial recharge schemes implemented is essential to assess the efficacy of structures constructed. It helps in identification of cost-effective recharge mechanisms for optimal recharge into the ground water system. It also helps to make necessary modifications in site selection, design and construction of structures in future. The monitoring system should be designed judiciously to monitor impact of these structures individually as well as collectively. Demarcation of the zone of influence of the artificial recharge structure is one of the main objectives of monitoring.
It is proposed to utilize the existing data available with the Government of Rajasthan and CGWB baseline data. For assessment of the impact of proposed measures additional data will be generated by construction of the piezometer at suitable and strategic sites.

It is proposed to construct 65 piezometer, one in each village, at suitable locations for monitoring of water levels, in the vicinity of proposed recharge structure. The depth of the piezometer may vary from 60 to 80 mbgl. This will help in assessing the impact of the project implementation.

Since the implantation of the Plan involves institutional framework, it is proposed to constitute State Level Technical Coordination Committee (SLTCC) and District Level Technical Coordination Committee (DLTCC) for proper monitoring and review of the implementation of the Plan.

Financial Outlay of the Plan

The total estimated cost of the Plan is 5.034 cr, which includes Rs 4.404 cr for ground water recharge activities, 0.39 cr for ground water monitoring (Piezometer construction) and Rs 0.24 cr towards operation and maintenance charges. The tentative cost estimates of the various activities of the Plan are shown in Table 5 & 6. The unit rates are as followed by the Govt. of Rajasthan (BSR). The total estimated cost of the project is **Rs 5.034 Crores**.

Table 5: Cost of the recharge structures

Cost of Percolation Tank in Rs in crs (Unit cost Rs 0.4 cr)	Cost Recharge Shaft Rs in crs (Unit cost Rs 0.05 cr for alluvium and Rs 0.026 cr for hard rock)
0.4	Hard rock – 4.004

Table 6: Tentative cost of different activities

Feasible Artificial Recharge & Water Conservation structures/ activities	**Tentative Design**	**Quantity (in nos. or area in sq. m)**	**Rainwater harvested (mcm)**	**Tentative unit cost (in Rs lakh)**	**Total tentative cost (in Rs lakh)**	**Expected Annual GW recharge/ conservation (mcm)**
Recharge Structures/ Activities						
Recharge shaft within the pond /tanks	Hard rock: Depth –60m, Dia 10-12”with filter pit	154	4.62	2.6	400.4	3.22
Percolation tanks (3 fillings)	200m*200m*1.5m	1	0.21	40	40	0.15
Sub total					440.4	3.37
Impact assessment & Monitoring						
Piezometer	Up to 80 m bgl	65		0.6	39	
Impact assessment will be carried out by implementing agency						
O & M - 5% of total cost of the scheme					23.97	
TOTAL					**503.37**	
Note: Type, number and cost of structure may vary according to site after ground verification						

Time Schedule

The project is to be implemented in two years, however impact assessment will be carried out for five years**.** A time schedule for different activities is given in table 7.

Table 7: Time Schedule

Steps	1st phase	2th Phase	3rd Phase	4th Phase	5th Phase	6th Phase	7th Phase	8th Phase
Constitution of State Level Technical Coordination Committee (SLTCC) and District Level Technical Coordination Committee (DLTCC)	■							
Arranging meeting of SLTCC for provision available under the scheme, request to implementing agencies for submission of DPR		■	■					
Scrutiny, recommendations & approval of AR Projects / Schemes in DLTCC & SLTCC		■	■					
Forwarding the DPR to Central Ground Water Board (CHQ), New Delhi for approval and issuing of sanction from the Ministry		■	■					
Meeting of TCC(CHQ) and release of sanction of funds		■	■					
Construction of artificial recharge structures & Monitoring of water levels in the area locally				■	■			
Completion and Utilisation certificate						■	■	
Impact Assessment and submission of report								■

Expected Benefits or outcome of the Plan

Ground water recharge and water conservation Plan of Sahada block, Bhilwara envisages gainful utilization of 3.37 MCM of surplus monsoon runoff for recharging of depleted aquifer system.

With the additional recharge and water conservation interventions as proposed in the Plan, it is anticipated that with enhanced recharge and reduction in ground water draft, the stage of ground water development will reduce to 116.01 % from the existing 133.87%. The projected status of ground water resources and utilization scenario is presented in table 8.

Table 8: Projected Status of Groundwater Resource & Utilization

Net G.W. Availability (mcm)	Additional Recharge from RWH & conservation (mcm)	Total Net G.W. Availability after intervention (Ham)	Existing G.W Draft for all purpose (ham)	Saving of Ground water through projects (ham)	Net GW draft after interventions (ham)	Present stage of G.W. development (%)	Projected stage of G.W. Dev. (in %)
21.8959	3.37	25.2659	29.3122	0	29.3122	133.87	116.01

- The implementation of the project would result in additional recharge. The other tangible/ non-tangible benefits of the project are:

- Recharging the ground water will help in arresting the rapid decline in ground water resources and will also ensure improvement in quality of ground water by way of dilution.
- Proposed structures and measures will also enhance the ground water potential and would ensure sustainability of ground water resources.
- Surface runoff water stored or harnessed can be used as supplemental irrigational resources and will reduce the stress on the ground water.
- Besides, it will also help in reducing the amount and spate of storm water being drained by river and controlling soil erosion.