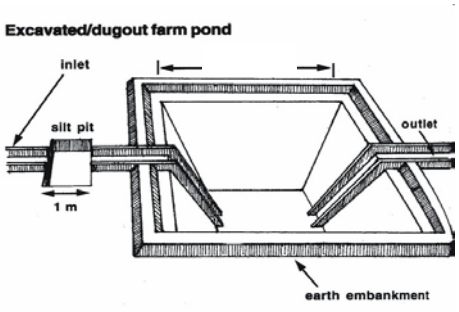
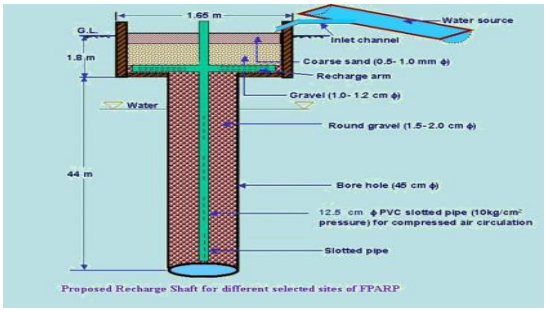
CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION
GOVERNMENT OF INDIA





ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF KHETRI BLOCK, DISTRICT JHUNJHUNU, RAJASTHAN

Western Region, Jaipur
January, 2016

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN BLOCK KHETRI, DISTRICT JHUNJHUNU

Plan at a Glance

1.	**Area of the Khetri Block**	**831.44 Sq.Km.**
2.	**Area identified for Artificial Recharge**	**575.47 Sq.Km**
3.	**Dynamic Ground Water Resources (as on 31.03.2011)**	
	Net Ground Water Availability	**29.05 MCM**
	Annual Ground Water Draft	**71.75 MCM**
	Stage of Ground Water Development	**246.93 %**
4.	**Runoff available in the block** **Volume of water recharged** **Volume of water conserved for other interventions**	**3.9635 MCM** **2.058 MCM** **0.707 MCM**
5.	**Volume of unsaturated aquifer zone available for recharge**	**838.865 MCM**
6.	**Total number of structures to be proposed**	
	Recharge structures **Existing village pond with recharge shaft/ well** **Percolation tank** **Water Conservation** **Farm pond**	**Numbers** **58 shafts (58 Nos. of existing village ponds)** **06 Nos.** **20 Nos.**
	Expected Annual GW recharge	**2.058 MCM**
	Provision for supplemental irrigation, thus reducing GW withdrawal for irrigation	**0.707 MCM**
	Total recharge/ saving of ground water	**2.765 MCM**
7.	**Estimated Cost** Artificial Recharge Plan Water conservation measures Piezometer construction Operation and maintenance	**6.8397 crore** 4.22 crore 2 crore 0.294 crore 0.3257 crore

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN BLOCK KHETRI, DISTRICT JHUNJHUNU

1 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 **Khetri Block, district Jhunjhunu** 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 **156.99%.** 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 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

1.1 Location of the block

The Khetri Block covering an area of 831.44 Sq. Km. falls in south eastern part of Jhunjhunu District and is located between North latitudes 27°47’ & 28°06’ and East longitudes 75°37’ & 76°03’. As per 2011 census, the total population of the Block is 259737 persons consisting of 135757 males & 123980 females and population density is 312 persons/ Sq. Km. Location map is shown in fig 1.

1.2 Source wise Irrigated Area

Out of total area of 831.44 Sq.Km., an area of 232.40 (27.95%) falls under irrigation. The dug wells/ Tubewells are the main source of irrigation in Khetri Block. There is very little area of 0.1 Sq.Km. area that falls under canal irrigation. The wells irrigate total 232.3 Sq.Km. area in this Block.

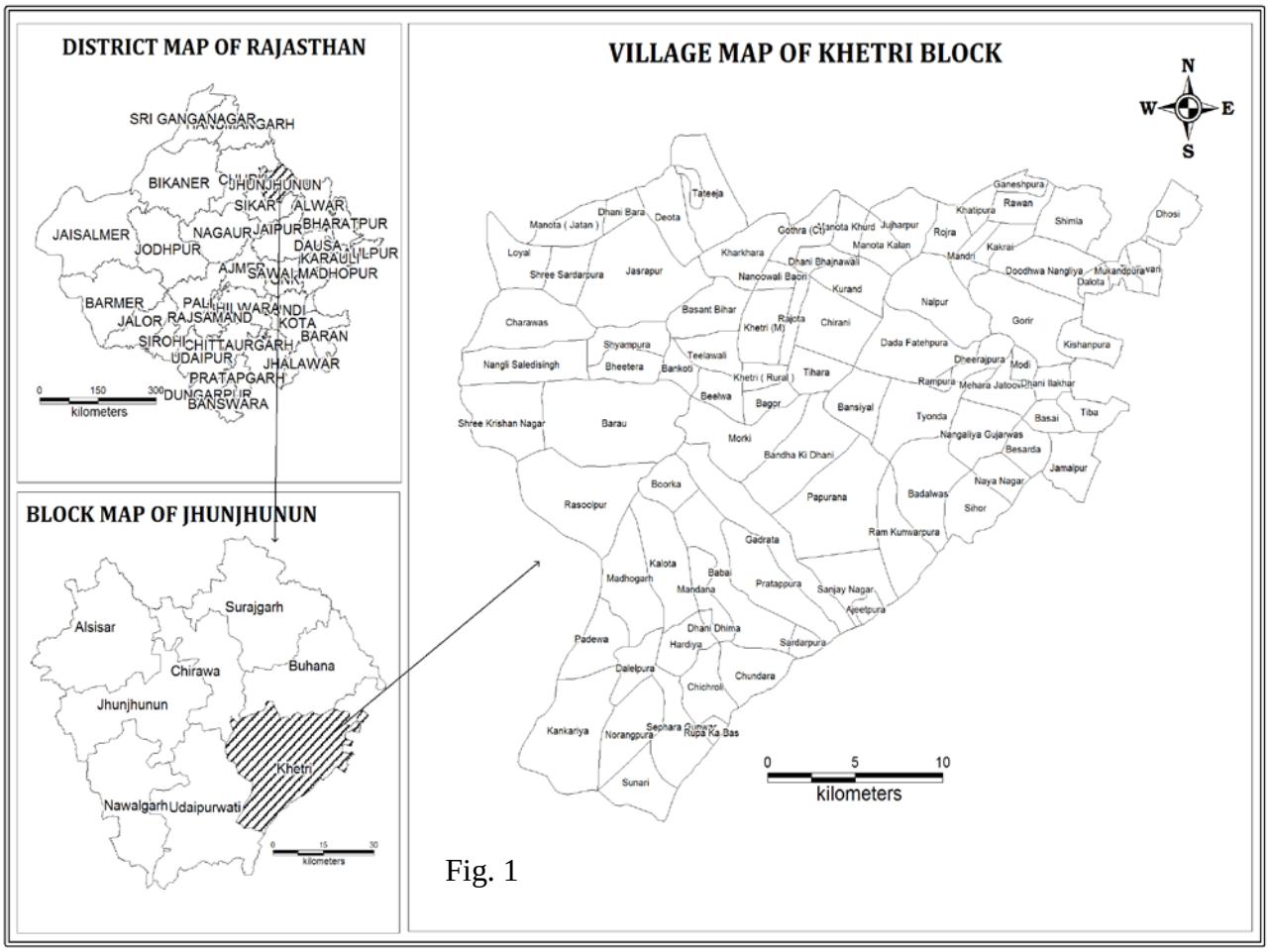


Fig. 1

1.3 Physiography & Drainage

Physiographically (Fig 2), the block is characterized by presence of alluvial plains, buried pediments & hills. The minimum and maximum elevation of Block is 307.1 m. amsl and 774.2 m. a.msl, respectively.

There is no perennial river flowing in this Block. It is drained by ephemeral Sukhnadi in northern part & Chandrawati in eastern parts. The major part of block falls under Shekhawati (Mendha) basin. The map showing drainage and water bodies in the Khetri block is shown in fig 3.

Fig: 2

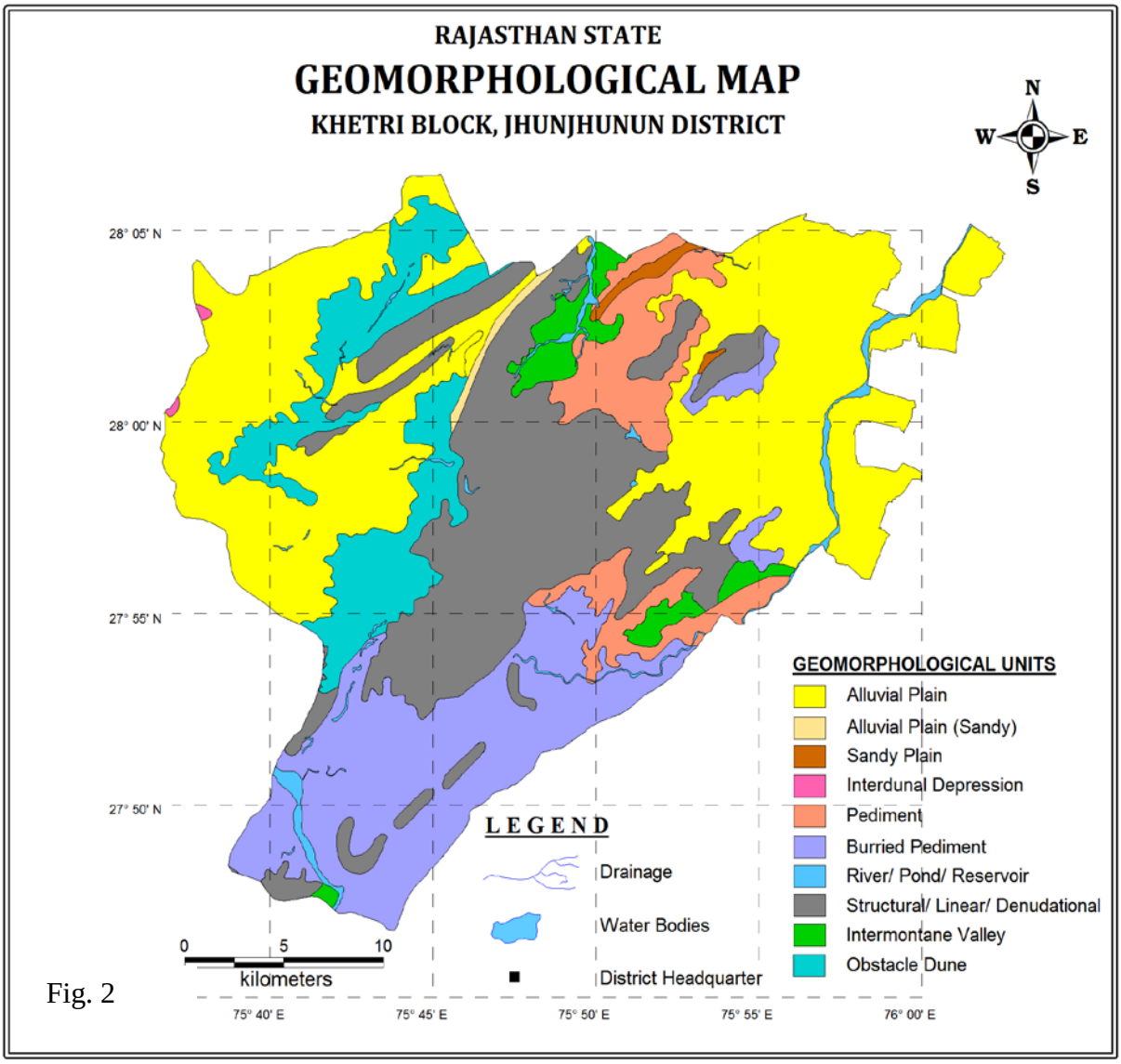

RAJASTHAN STATE
GEOMORPHOLOGICAL MAP
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
0
5
10
kilometers
LEGEND
Drainage
Water Bodies
District Headquarter
GEOMORPHOLOGICAL UNITS
Alluvial Plain
Alluvial Plain (Sandy)
Sandy Plain
Interdunal Depression
Pediment
Burried Pediment
River/ Pond/ Reservoir
Structural/ Linear/ Denudational
Intermontane Valley
Obstacle Dune

Fig. 2

Fig: 3

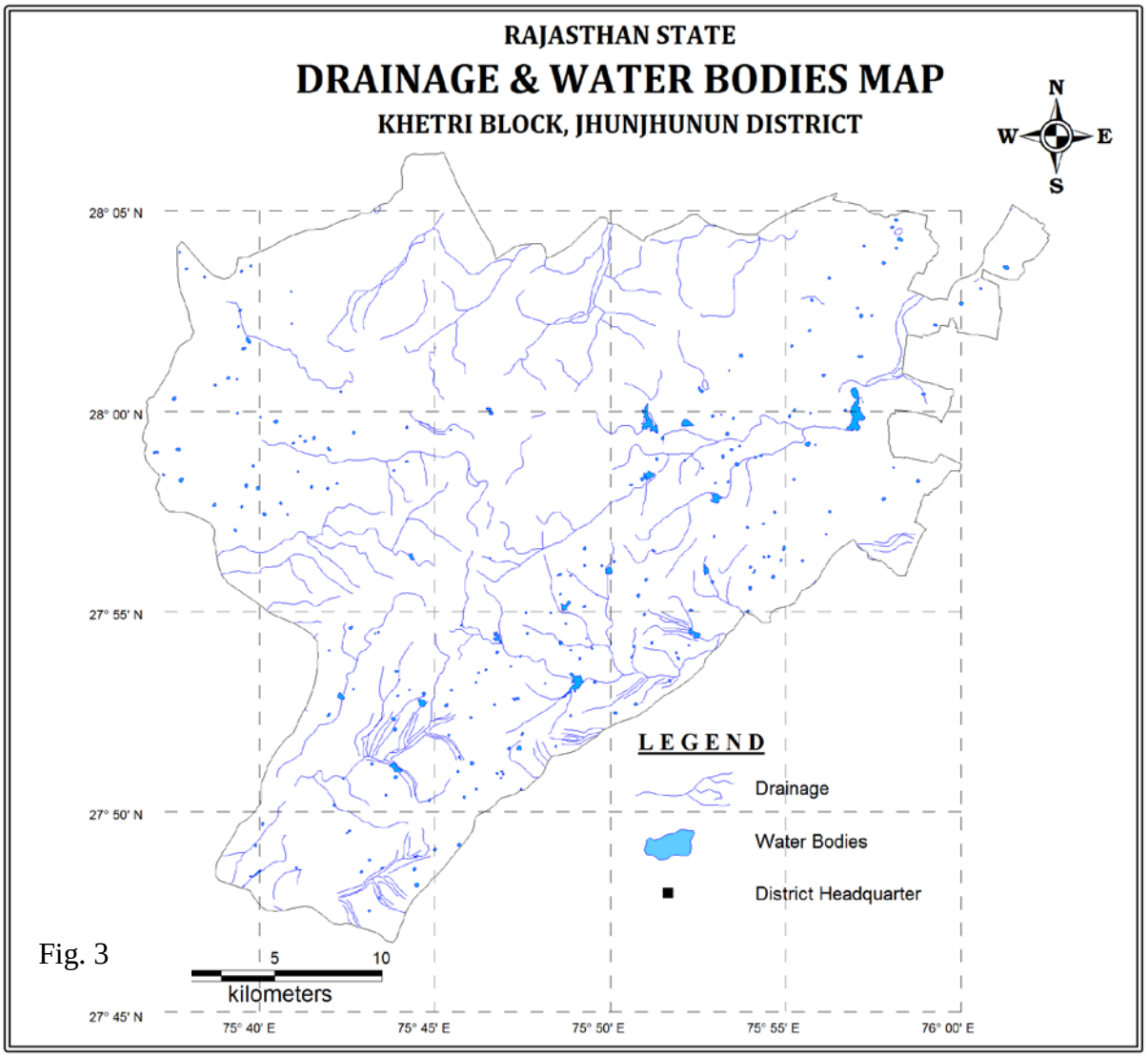


Fig. 3

1.4 Rainfall

The climate of the block is semi arid. The Normal annual rainfall of block is 562.83mm. Failure of rains has observed several times. The available data of rainfall indicates that larger part of annual rainfall is received through SW monsoon during July to September. In March, there is transition to summers. The summer months of April to June are the hottest months and temperature upto 48°C is reached. From end of June to September, south western monsoon is received. The months of July and August are the wettest

months, receiving about 70% of total annual rainfall. Winter season starts from November and lasts upto February. Average temperature during these months remains between 15° to 18°C, however from end of December to mid January, temperature remains in the range of 5° to 10°C.

1.5 Hydrogeology of the Area

Quaternary alluvium is the principal water bearing formation and hard rocks of Delhi Super Group including post Delhi Intrusive form ancillary aquifers in the block. Alluvium (composed of sand, silt, clay, kankar and gravel) forms the principal and potential aquifer in the area. Out of total geographical area of 819.44 Sq. Km, areas of 183.73 Sq. Km. (22.42%) under Older alluvium & 392.1 Sq,Km. (47.85%) under Quartzites form potential zones and remaining 243.61 Sq. Km.(29.75%) area is represented by hills. Ground water occurs under unconfined to semi-confined conditions in the primary porosity i.e. pore spaces. Quartzite, schist, phyllite, gneisses and limestone of Delhi Super Group including granites, amphibolites and pegmatites of post Delhi intrusives form the ancillary aquifer. Ground water occurs under unconfined condition in the weathered mantle (ranging in thickness from 10 to 15 m) and under unconfined to semi-confined conditions in deep seated secondary porosity i.e. fractures, joints, contacts etc. of hard formation. In general yield of wells tapping alluvial aquifers varies from 2.92 to 15 lps depending on the thickness of saturated granular zones and yield of the wells tapping hard rock aquifers in ranges from 0.83 to 12.08 lps. The map showing aquifer systems in the Khetri block is shown in **Fig. 4**

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 60-70 and 70-80 m bgl range with the southern area showing 20-50 and 50-60 m bgl range. **(Fig 5)**
The average decadal depth to water level is 20.7 mbgl for Pre monsoon & 19.83 mbgl for Post monsoon. According to depth to water level maps of May 2014 & November 2014, the water level ranges between 20 to 40 mbgl in major part. In few north western & north eastern parts, deep water level more than 40 mbgl has been observed. The Map showing Depth to water level for May, 2014 and November, 2014 is shown in **Fig 6 & 7.**

Water Level Trend:

The hydrographs of wells monitored by CGWB & GWD from 1997 to 2010 shows declining water level trend. A water level fall of 0.19 m/year during pre monsoon and 0.19 m/year during post monsoon has been observed for this period.
As per the Decadal Water level trend (from November, 2005 to November, 2014), the declining trend is visible in the block. The fall majorly show trend of 0 to 1 and 1 to 2. The map of Decadal Water Level Trend is shown in **fig. 8**.

Fig: 4

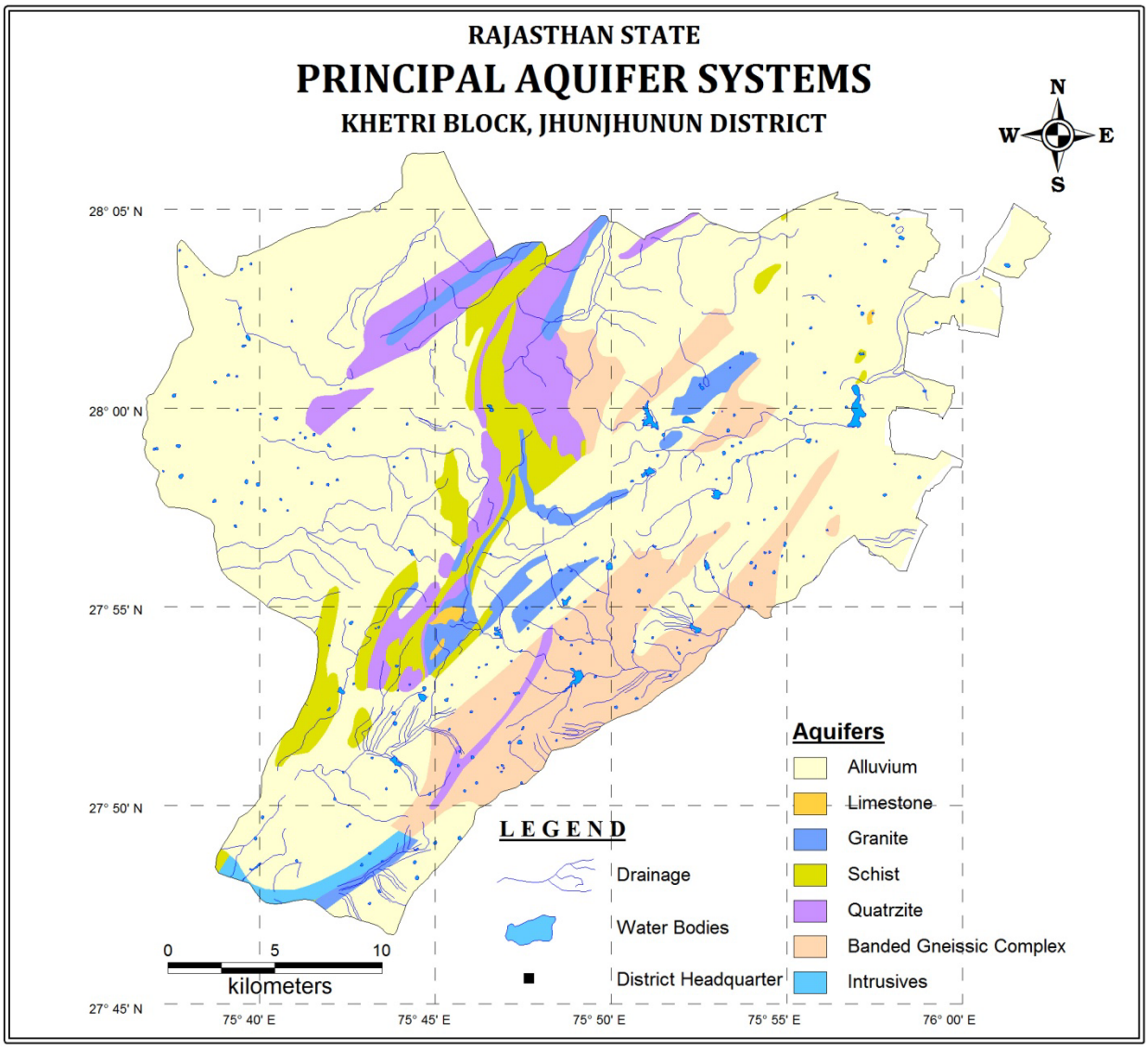

RAJASTHAN STATE
PRINCIPAL AQUIFER SYSTEMS
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
27° 45' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
0
5
10
kilometers
LEGEND
Drainage
Water Bodies
District Headquarter
Aquifers
Alluvium
Limestone
Granite
Schist
Quatrzite
Banded Gneissic Complex
Intrusives

Fig: 5

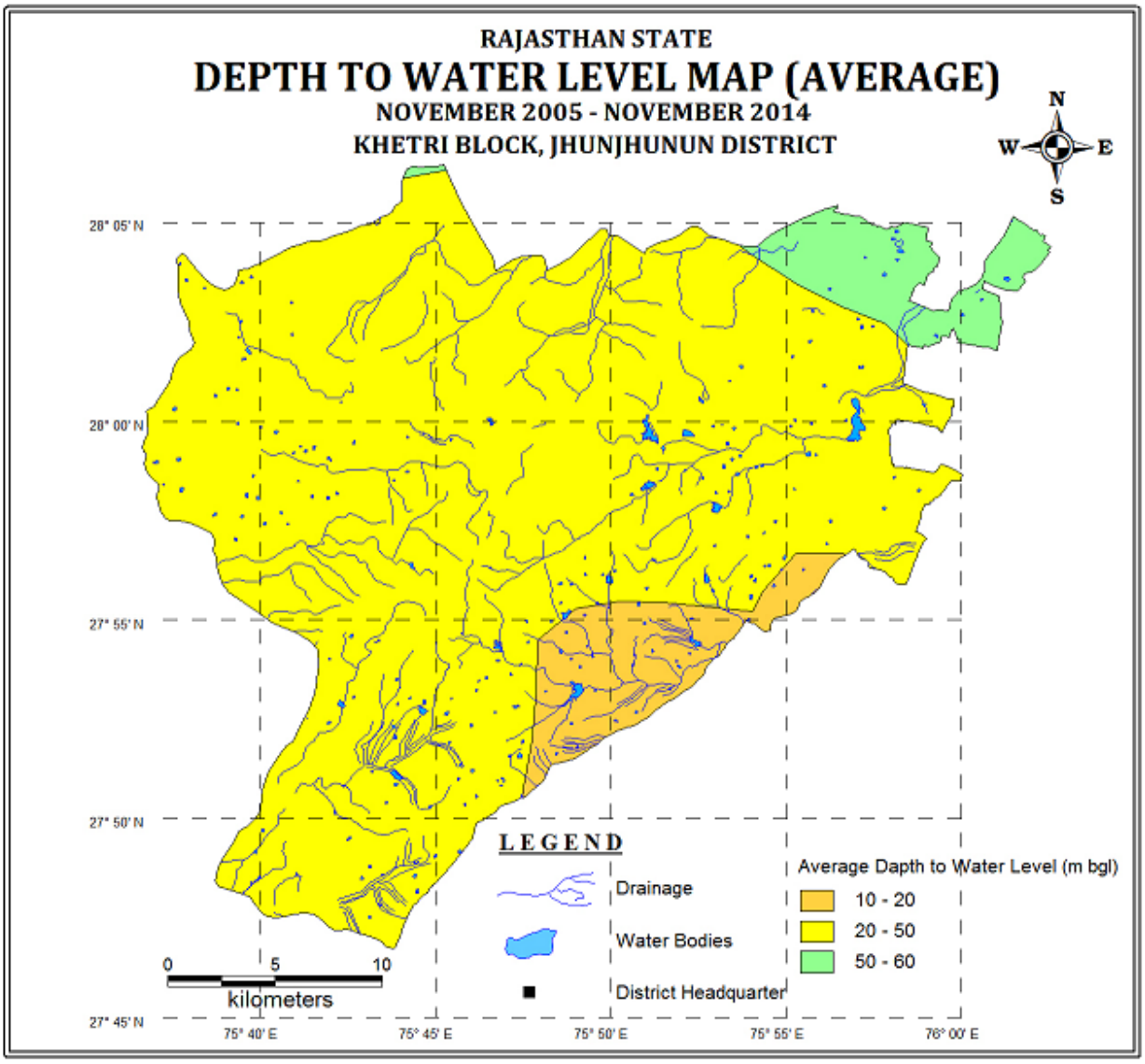

RAJASTHAN STATE
DEPTH TO WATER LEVEL MAP (AVERAGE)
NOVEMBER 2005 - NOVEMBER 2014
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
27° 45' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
LEGEND
Drainage
Water Bodies
District Headquarter
Average Dapth to Water Level (m bgl)
10 - 20
20 - 50
50 - 60
0
5
10
kilometers

Fig: 6

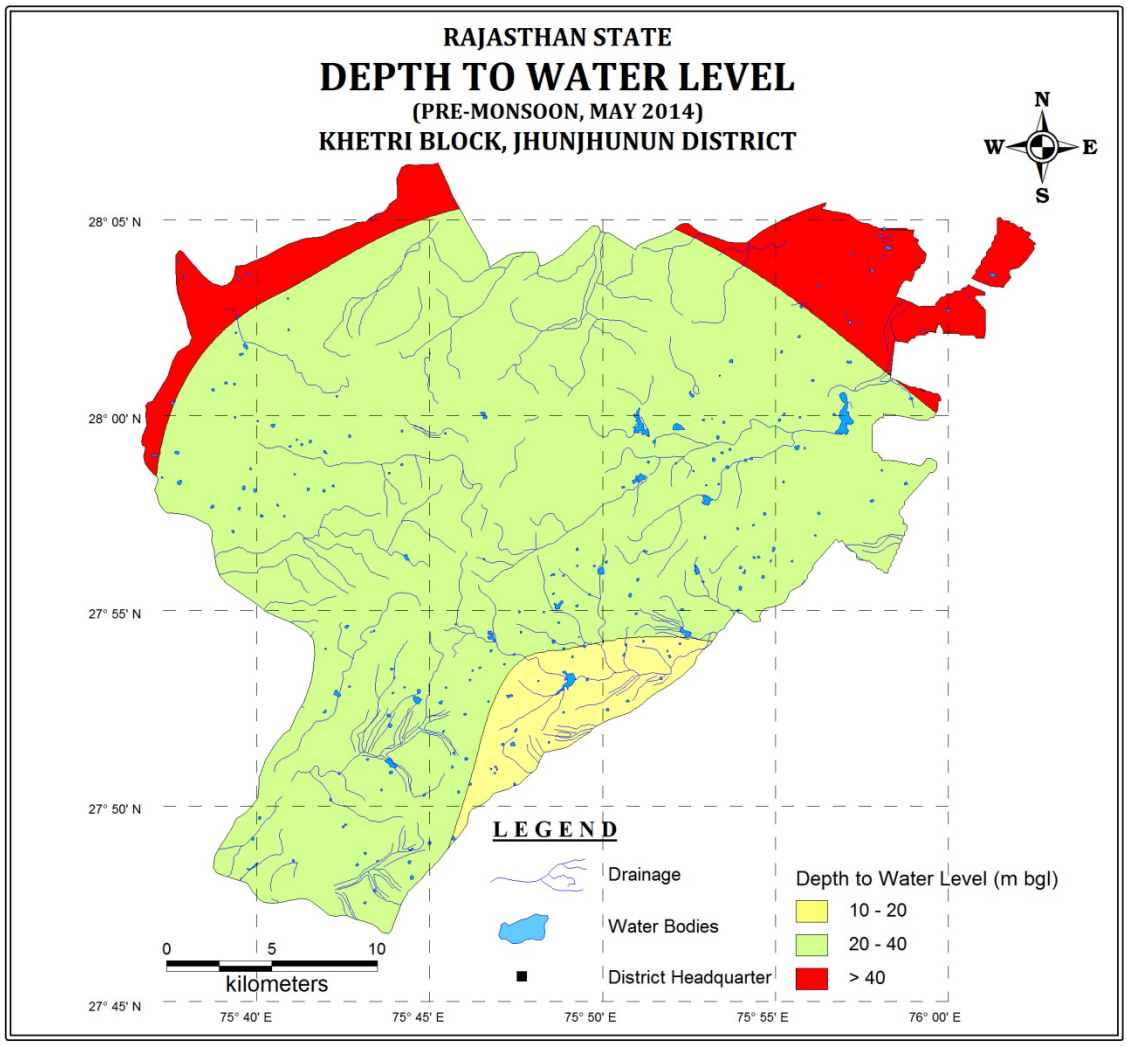

RAJASTHAN STATE
DEPTH TO WATER LEVEL
(PRE-MONSOON, MAY 2014)
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
27° 45' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
0
5
10
kilometers
LEGEND
Drainage
Water Bodies
District Headquarter
Depth to Water Level (m bgl)
10 - 20
20 - 40
> 40

Fig: 7

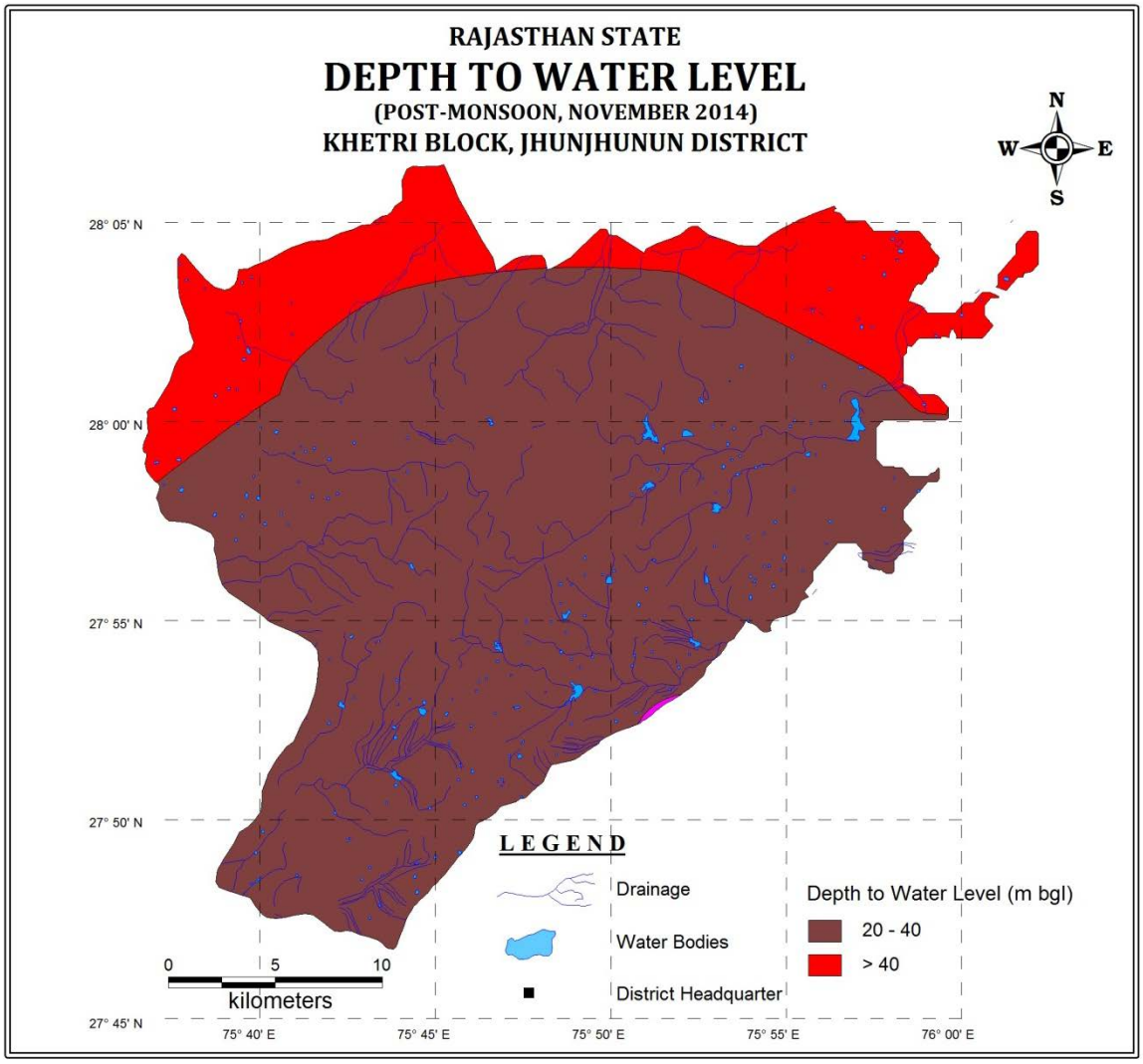
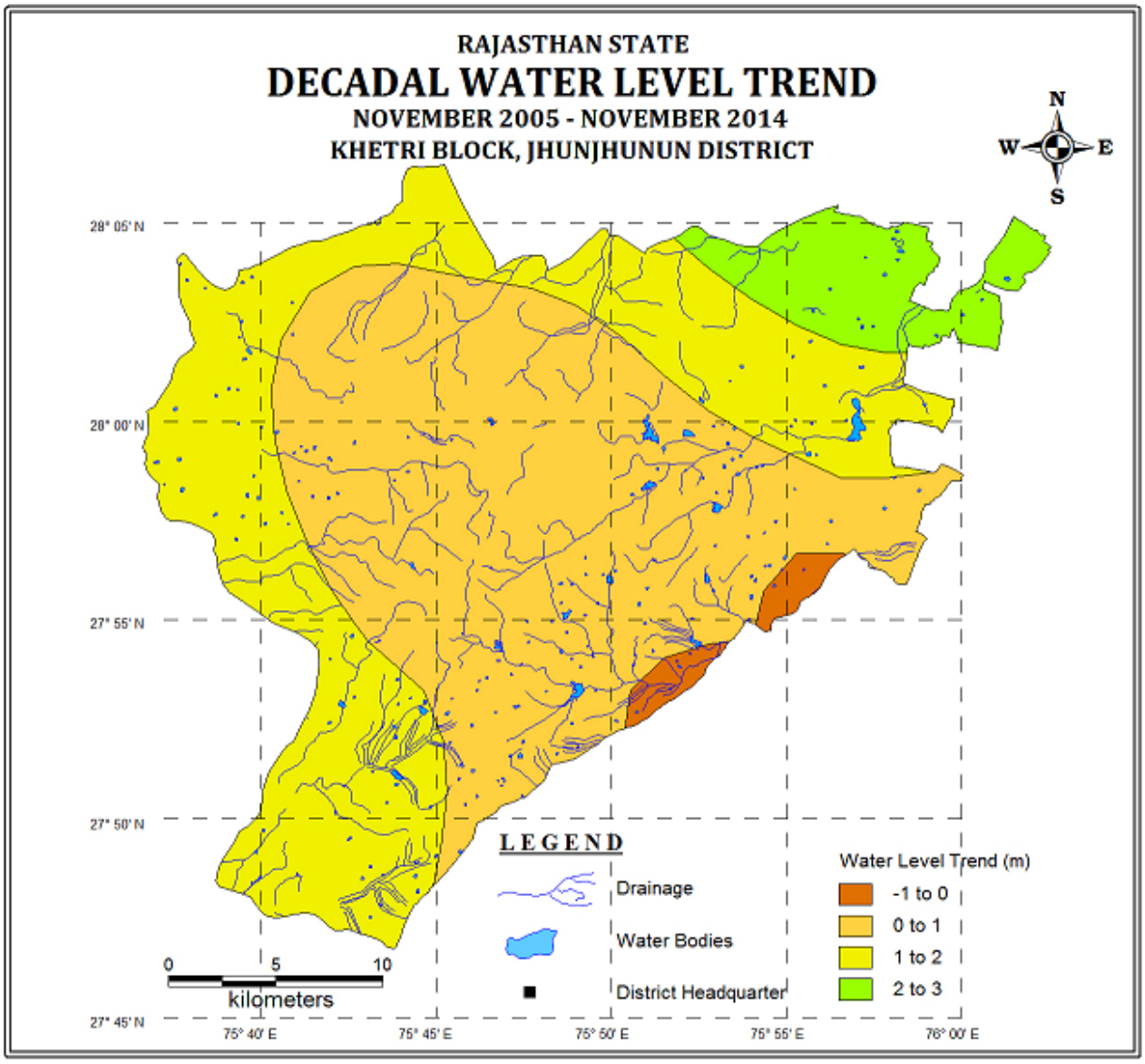

RAJASTHAN STATE
DEPTH TO WATER LEVEL
(POST-MONSOON, NOVEMBER 2014)
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
27° 45' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
LEGEND
Drainage
Water Bodies
District Headquarter
Depth to Water Level (m bgl)
20 - 40
> 40
0
5
10
kilometers

Fig: 8


RAJASTHAN STATE
DECADAL WATER LEVEL TREND
NOVEMBER 2005 - NOVEMBER 2014
KHETRI BLOCK, JHUNJHUNUN DISTRICT
N
W
E
S
28° 05' N
28° 00' N
27° 55' N
27° 50' N
27° 45' N
75° 40' E
75° 45' E
75° 50' E
75° 55' E
76° 00' E
0
5
10
kilometers
LEGEND
Drainage
Water Bodies
District Headquarter
Water Level Trend (m)
-1 to 0
0 to 1
1 to 2
2 to 3

1.6 Subsurface Hydrogeology

As inferred from borehole data of the Khetri Block; Alluvium, Schist, Phyllite & Quartzite form the aquifers. However, the ground water in Schist, Phyllite, Quartzite only occurs in shallow weathered parts or fractures due to absence of primary porosity. Exploratory bore hole data has revealed the presence of aquifer system down to the depth of 100 m in general. The depth of drilling ranges from 27.74 to 125.85 mbgl and the average discharge ranges from 2.52 to 45.72 lps. The quality of water has 2 major problems, i.e., Salinity & Fluoride. Transmissivity value varies between 255 to 7766 m^2/day and Stortivity varies from 0.000156 to 0.00074.

1.7 Dynamic Ground Water Resource

The Ground water Resources for the block are given in Table 1, as per 31.03.2011 Ground Water Resource Assessment. The Net Ground water Availability of Block is 3145.43 ham and Annual Ground water draft is 4937.97 ham. Due to this excessive draft over recharge, stage of Ground water development has reached 156.99%.

Table 1: Ground Water Availability, Utilization and Stage of Development Khetri Block, Jhunjhunu District

Natural Discharge During Non Monsoon Period	232.59 ham
Net Ground Water Availability	3145.43 ham
Annual Ground Water Draft	4937.97 ham
Net Ground water Availability for Future Irrigation Use	0 ham
Stage of Ground Water Development	156.99%
Source: Ground Water Resource Assessment 31.03.2011	

Proposal for Artificial Recharge

Generally the Artificial recharge structures suitable in this type of area are Check dams/ Anicuts/ Percolation tanks and Recharge Shafts/ Recharge wells. Since the water levels are quite deep in the block (upto 40 mbgl), the structures like Percolation tanks and Check dams are not very suitable. Besides a large number of Check dams/ Anicuts have already been constructed by different State Government Agencies at most of the feasible locations. Considering this aspect it is felt that Recharge Shaft/ Recharge wells are the most suitable structures.

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. Since natural recharge from these ponds is limited due to siltation and ground water levels are deep, the most effective ground water structure would be Recharge Shaft/ Recharge well constructed within the pond itself.

Such a Recharge well needs to be designed in a manner that maximum surplus water is utilized for recharge as well as sufficient water is retained in the pond for local use.

The design of typical Recharge well is given in Figure 8a and 8b. 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 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.

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 villages. 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 2.5 ha. Therefore, more number of such Recharge wells may be required for larger ponds.

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 3.9735 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	Average DTW (mbgl) NOV 2013
JHUNJHUNUN	RJ21	**KHETRI**	RJ2105	831.44	575.83	alluvium	183.37	0.100	35
JHUNJHUNUN	RJ21	**KHETRI**				hard rock	392.10	0.030	24.43

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

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)	Remaining Surplus water for Farm Ponds (FP)	No. of FP (0.05 MCM/ FP)
32	586.784	Kantli	0.4010	**0.39**	13	**0**	0	**0**	0
21.43	252.081	Dohan	3.5625	**1.35**	45	**1.2**	6	**1.01**	20
			3.9635	**1.74**	58	**1.2**	6	**1.01**	20

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 831.44 sq km practically 575.47 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

Khetri block is having ground water level mostly ranges 20 to 40m below ground level and as per dynamic ground water resource estimation, the block is over exploited with stage of ground water development at 156.99%. The Khetri 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 these aspects, the proposal for Recharge Shaft/ Recharge wells and percolation tanks have been firmed up in the present Plan are the most suitable structures in Khetri block.

Details of Ground Water Recharge Measures

1. 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 9a & 9b. 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.

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 2.5 ha. Therefore, more number of such Recharge wells are envisaged for larger ponds.

Fig 9a

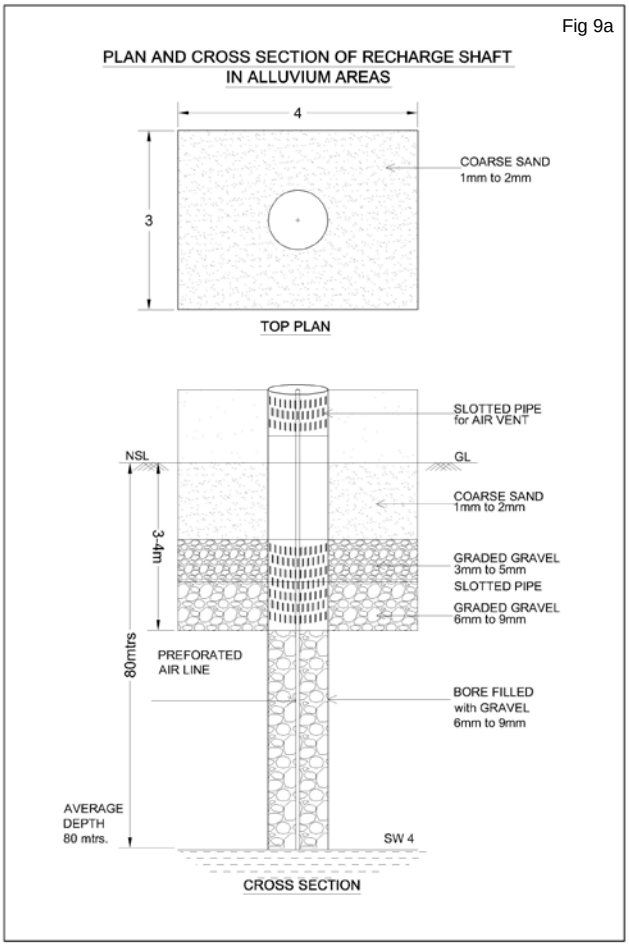
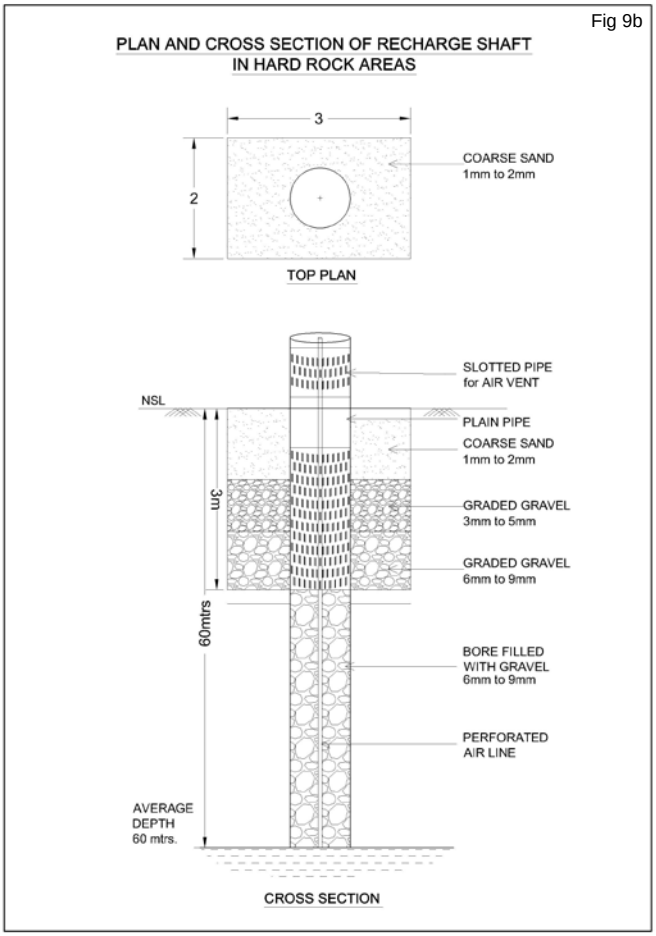


Fig 9b



The tentative location of villages for construction of recharge shaft/well in existing village pond and their cost estimates are shown in Fig 10 and Table 3. The plan proposes construction of 58 recharges shafts/ wells in 58 identified existing village ponds at an estimated cost of 182 lacs.

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

S.N	Village	Long	Lat	Pond Area (Ha)	No of Shaft	Formation	Unit cost (Rs in lac)	Cost of Shaft (Rs in lac)
1	Charawas	75.626	28.005	1.970	1	Soft	5	5
2	Shree Krishan Nagar	75.628	27.984	2.469	1	Soft	5	5
3	Shree Krishan Nagar	75.629	27.971	2.932	1	Soft	5	5
4	Shree Krishan Nagar	75.645	27.961	1.770	1	Soft	5	5
5	Barau	75.660	27.969	2.130	1	Soft	5	5
6	Barau	75.666	27.968	1.924	1	Soft	5	5
7	Kankariya	75.667	27.809	3.519	1	Hard rock	2.6	2.6

8	Nangli Saledisingh	75.674	27.996	2.005	1	Soft	5	5
9	Madhogarh	75.705	27.881	5.848	1	Hard rock	2.6	2.6
10	Madhogarh	75.710	27.910	1.998	1	Soft	5	5
11	Kalota	75.730	27.872	2.161	1	Hard rock	2.6	2.6
12	Hardiya	75.731	27.868	2.324	1	Hard rock	2.6	2.6
13	Hardiya	75.731	27.852	11.509	1	Hard rock	2.6	2.6
14	Boorka	75.739	27.939	3.769	1	Hard rock	2.6	2.6
15	Sephara Gunwar	75.740	27.809	1.788	1	Hard rock	2.6	2.6
16	Sephara Gunwar	75.741	27.803	2.127	1	Hard rock	2.6	2.6
17	Kalota	75.744	27.879	8.809	1	Hard rock	2.6	2.6
18	Kalota	75.745	27.882	1.973	1	Hard rock	2.6	2.6
19	Sephara Gunwar	75.750	27.818	1.834	1	Hard rock	2.6	2.6
20	Dhani Dhima	75.755	27.878	1.937	1	Hard rock	2.6	2.6
21	Rupa Ka Bas	75.762	27.820	2.153	1	Hard rock	2.6	2.6
22	Chundara	75.768	27.854	1.800	1	Hard rock	2.6	2.6
23	Khetri (M)	75.776	28.000	4.819	1	Hard rock	2.6	2.6
24	Pratappura	75.780	27.906	8.472	1	Hard rock	2.6	2.6
25	Babai	75.788	27.880	2.351	1	Hard rock	2.6	2.6
26	Chundara	75.790	27.860	3.240	1	Hard rock	2.6	2.6
27	Sanjay Nagar	75.810	27.903	1.929	1	Hard rock	2.6	2.6
28	Papurana	75.812	27.919	8.032	1	Hard rock	2.6	2.6
29	Papurana	75.833	27.934	7.594	1	Hard rock	2.6	2.6
30	Gadrata	75.836	27.874	1.379	1	Hard rock	2.6	2.6
31	Papurana	75.847	27.923	1.953	1	Hard rock	2.6	2.6
32	Bansiyal	75.851	27.973	13.006	1	Hard rock	2.6	2.6
33	Bansiyal	75.858	27.989	1.672	1	Hard rock	2.6	2.6
34	Dada Fatehpura	75.870	27.995	11.912	1	Hard rock	2.6	2.6
35	Ram Kunwarpura	75.872	27.917	1.339	1	Hard rock	2.6	2.6
36	Ram Kunwarpura	75.873	27.908	10.119	1	Hard rock	2.6	2.6
37	Dada Fatehpura	75.876	28.009	3.038	1	Hard rock	2.6	2.6
38	Badalwas	75.879	27.934	5.690	1	Hard rock	2.6	2.6
39	Tyonda	75.884	27.964	13.286	1	Hard rock	2.6	2.6
40	Tyonda	75.887	27.981	1.936	1	Hard rock	2.6	2.6
41	Rampura	75.889	27.991	1.916	1	Hard rock	2.6	2.6
42	Tyonda	75.894	27.978	1.618	1	Hard rock	2.6	2.6
43	Nalpur	75.895	28.023	1.803	1	Hard rock	2.6	2.6
44	Sihor	75.900	27.926	2.089	1	Hard rock	2.6	2.6
45	Sihor	75.911	27.931	1.411	1	Hard rock	2.6	2.6
46	Naya Nagar	75.916	27.943	1.736	1	Hard rock	2.6	2.6
47	Mehara Jatoowas	75.927	27.986	3.641	1	Hard rock	2.6	2.6
48	Gorir	75.952	28.023	2.094	1	Hard rock	2.6	2.6

49	Doodhwa Nangliya	75.953	28.040	2.029	1	Hard rock	2.6	2.6
50	Jamalpur	75.963	27.963	1.408	1	Soft	5	5
51	Gorir	75.928	28.034	1.744	1	Hard rock	2.6	2.6
52	Dheerajpura	75.919	27.998	1.449	1	Hard rock	2.6	2.6
53	Sihor	75.902	27.933	1.556	1	Hard rock	2.6	2.6
54	Gorir	75.935	28.015	3.345	1	Hard rock	2.6	2.6
55	Tiba	75.980	27.971	1.356	1	Soft	5	5
56	Kishanpura	75.982	28.007	1.494	1	Soft	5	5
57	Besarda	75.938	27.958	1.454	1	Soft	5	5
58	Nangaliya Gujarwas	75.911	27.958	3.510	1	Soft	5	5
	Total				58			182

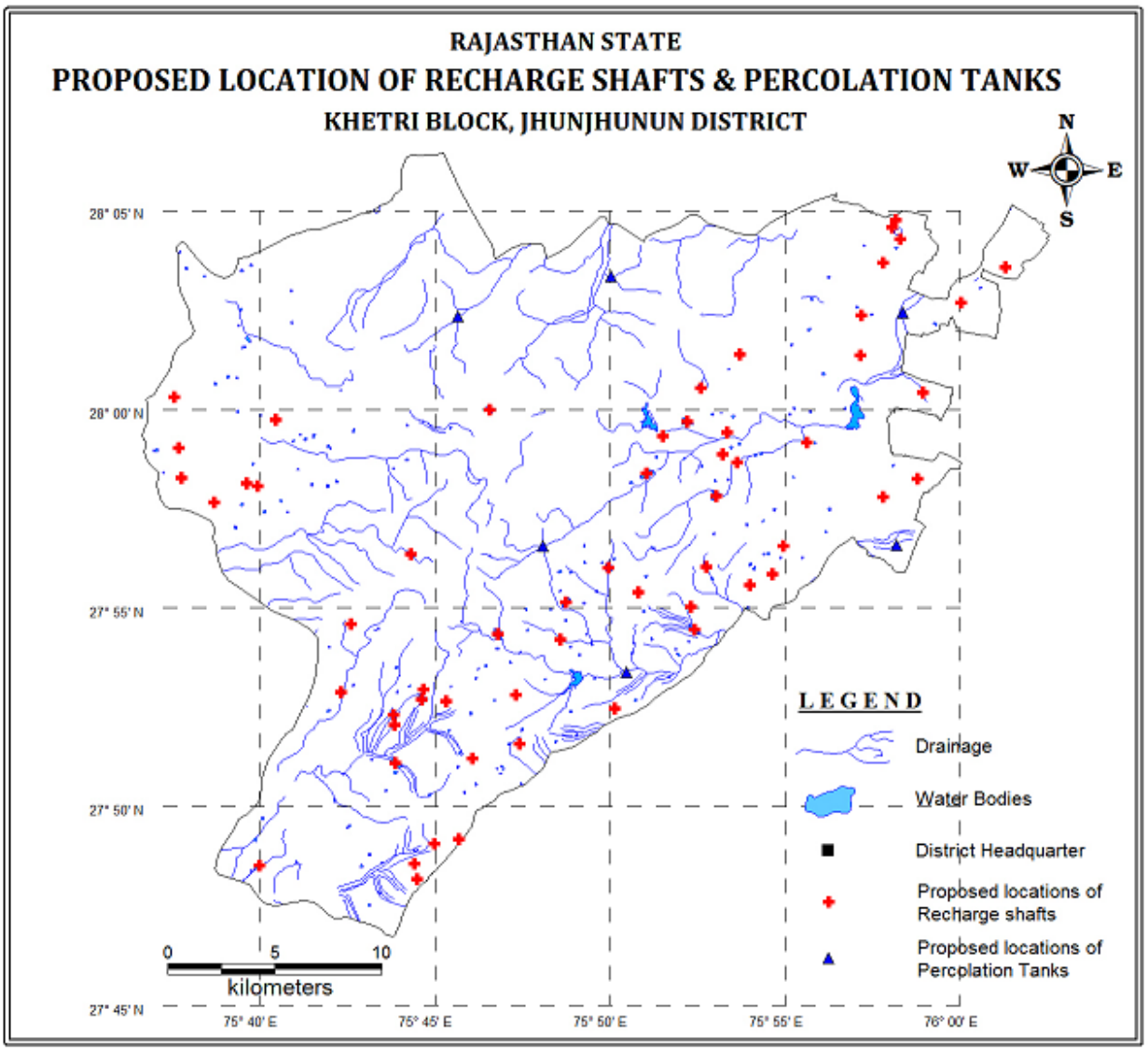
2. Percolation tanks

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, 35 Nos. percolation tanks (200mx200mx1.5m) in the vicinity of respective villages. Location of percolation tanks is given in Fig 10 and Table 4.

Table 4: Tentative location of village proposed for percolation tank

SN	District	Block	Village	Longitude	Latitude
1.	Jhunjhunun	Khetri	Bandha Ki Dhani	75.8013	27.9427
2.	Jhunjhunun	Khetri	Basant Bihar	75.7607	28.0389
3.	Jhunjhunun	Khetri	Sanjay Nagar	75.841	27.8898
4.	Jhunjhunun	Khetri	Manota Khurd	75.8338	28.0557
5.	Jhunjhunun	Khetri	Doodhwa Nangliya	75.9727	28.0406
6.	Jhunjhunun	Khetri	Jamalpur	75.9695	27.943

Fig: 10



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.

A. Farm Ponds

A farm pond is a large hole dug out in the earth, usually square or rectangular in shape, which harvests rainwater and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available, the type of soil, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. Water from the farm pond is conveyed to the fields manually, by pumping, or by both methods. Pictorial diagram of farm pond is shown in fig 11.

Advantages of Farm Ponds

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees, thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimize siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock
- They promote fish rearing.
- They recharge the ground water.
- They improve drainage.
- The excavated earth has a very high value and can be used to enrich soil in the fields, levelling land, and constructing farm roads

It is proposed to construct 20 farm ponds as per the specification of Govt. of Rajasthan (30 x 30 x 1.5 m). These farm ponds can accommodate about 1.01 MCM of runoff rainfall considering 3 fillings. Farm ponds can be constructed in the village at feasible location. Dimension of the farm pond depends on land holdings

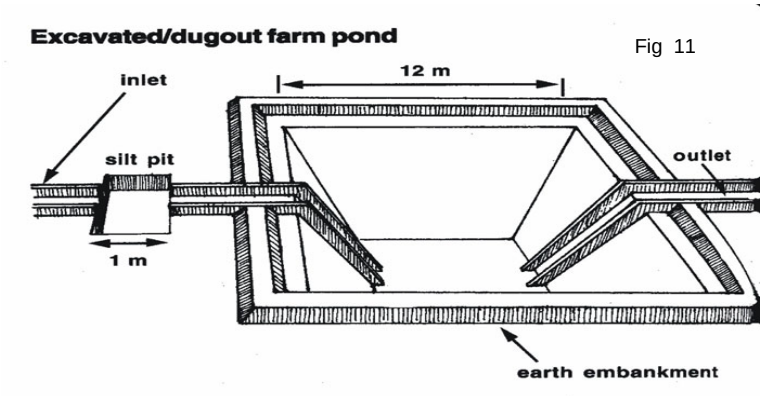


Fig 11

B. 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 49 piezometer, at suitable locations for monitoring of water levels, in the vicinity of proposed recharge structure. The depth of the piezometer may vary from 20 to 50 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 6.8397 cr, which includes Rs 4.22 cr for ground water recharge activities, Rs 2 cr (Farm ponds), 0.294 cr for ground water monitoring (Piezometer construction) and Rs 0.3257 cr towards operation and maintenance charges. The tentative cost estimates of the various activities of the Plan are shown in Table 5 & 6.
The tentative cost for different activities is given in table 6. The unit rates are as followed by the Govt. of Rajasthan (BSR). The total estimated cost of the project is **Rs** 6.8397 **Crores**.

Table 5: Cost of the recharge structures

Cost Percolation Tank in Rs in crs (Unit cost Rs 0.4 cr)	Cost Farm Pond in Rs (Unit cost Rs 0.1 cr)	Cost Recharge Shaft Rs in crs (Unit cost Rs 0.05 cr for soft rock and 0.026cr. for hard rock)
2.4	2	Alluvium – 0.65
		Hard rock – 1.17

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	Alluvium – Depth 80m, Dia: 10-12" with filter pit	13	0.39	5	65	0.273
	Hard rock: Depth – 60m, Dia 10-12"with filter pit	45	1.35	2.6	117	0.945
Percolation tanks (3 fillings)	200m*200m*1.5m	6	1.2	40	240	0.84
Sub total					422	2.058
Water Conservation Activities						
Farm Pond (3 fillings)	(30 m x 30m x 1.5 m) 900 sq.m or 0.1 ha	20	1.01	10	200	0.707
Impact assessment & Monitoring						
Piezometer	Up to 80 m bgl	49		0.6	29.4	
Impact assessment will be carried out by implemneting agency						
O & M - 5% of total cost of the scheme					32.57	
TOTAL					**683.97**	

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 8.

Table 8: 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 Khetri block, Jhunjhunun envisages gainful utilization of 2.058 MCM of surplus monsoon runoff for recharging of depleted aquifer system. Besides this, the proposed intervention would also lead to reduction of pre-existing ground water draft by 0.707 MCM annually through construction of farm ponds.

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 145.23% from the existing 156.99%. The projected status of ground water resources and utilization scenario is presented in table 9.

Table 9 .Projected Status of Groundwater Resource & Utilization

Net G.W. Availability (Ham)	Additional Recharge from RWH & conservation (mcm)	Total Net G.W. Availability after intervention (mcm)	Existing G.W Draft for all purpose (mcm)	Saving of Ground water through projects (mcm)	Net GW draft after interventions (mcm)	Present stage of G.W. development (%)	Projected stage of G.W. Dev. (in %)
31.4543	2.058	33.5123	49.3797	0.707	48.6727	155.99	145.24

- 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.