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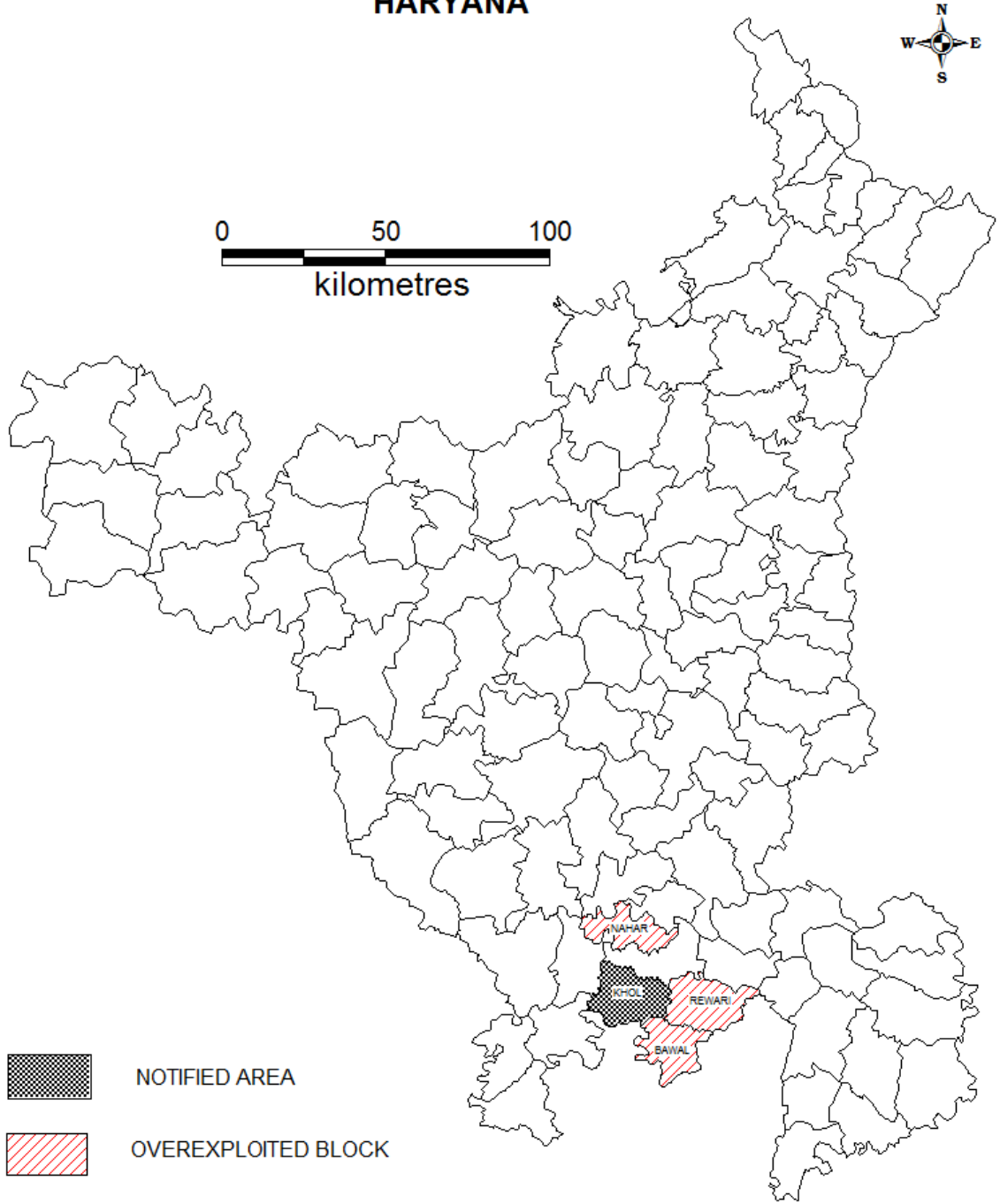
**Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Board**

PLAN ON

**ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN
OVEREXPLOITED BLOCKS OF
REWARI DISTRICT, HARYANA**

**Central Ground Water Board
North Western Region
Chandigarh**

**PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER
IN OVER EXPLOITED BLOCKS, DISTRICT REWARI
HARYANA**



PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT REWARI HARYANA

INTRODUCTION

Administratively, the district is divided into 3 sub-divisions/ tehsils namely Bawal, Kosli and Rewari. Further, the district has been sub-divided into five development blocks i.e. Bawal, Jatusana, Khol, Nahar and Rewari. Rewari district has 9 towns and 412 villages with a total population of 8,96,129 as per 2011 census.

HYDROMETEOROLOGY

The climate of the district can be classified as as tropical steppe, Semi-arid and hot which is mainly dry with very hot summer and cold winter except during monsoon when moist air of oceanic origin penetrates into the district. The normal annual rainfall is about 553 mm which is spread over 23 rainy days. 88% of rainfall occurs during south-west monsoon.

GEOMORPHOLOGY

The district broadly forms part of Indo-Gangetic alluvial plain of Yamuna sub basin. It has vast alluvial and sandy tracts and is interspersed strike ridges which are occasionally covered with blown sand. The Sand dunes attain a height of 30m but on an average they have height of 7 m with respect to surroundings. Some of the dunes support light vegetation where as others are of shifting nature depending upon the direction of wind. The hill ranges are part of great Aravalli chain and contain valuable mineral deposits and natural meadows. The elevation of land in the area varies from 232 m in the north to 262 m above mean sea level in south. The master slope of the area is towards the north. Due to arid climate, the soils are light coloured and moreover. Due to excessive evaporation, soils are calcareous and have lime nodules in the subsurface horizon. Tropical arid brown soils (Ustochcept, haplustarp and sales thids) exist in the Eastern part of the district: most of the soils are of medium texture. Loamy sand is the average textured in all blocks. The organic content of the soil ranges sand upto 0.40%. The available phosphorus in the soils ranges ground 21.5 kg/hectare. Soils have moderate salinity hazards, high salinity and moderate alkalinity hazard in the major part of the area.

HYDROGEOLOGY:

The district is occupied by Indo-Gangetic alluvial plain of Quaternary age, and falls in Ghaggar basin. The principal ground water reservoirs in the area are unconsolidated alluvial deposits of quaternary age. Hard rocks also have some amount of ground water which circulate through joint, fractures & cracks. Over most part of the area ground water occur under phreatic conditions, whereas in deeper water bearing zones which are overlain by impermeable clay it occurs under semi confined to locally confined conditions. The shallow aquifers are being tapped by the handpumps and shallow tubewells, which are widely used for the domestic purposes. CGWB has drilled 16 exploratory borewells and 5 piezometer to delineate and determine potential aquifer zones, evaluation of the aquifer characteristics. The deepest slim hole was drilled upto the depth of 203.85m at Chandanwas.

Alluvium comprises very fine to coarsesand, gravel, silt and clay with kanker in varying proportions. The permeable granular zones comprising sand and occasionally coarse sand and gravel. Their lateral and vertical extent is limited. The borehole data reveals that clay group of formations dominate over the sand group in the district area. The discharge of deep tubewell in the area varies between 358 and 2911 lpm. The transmissivity values ranges from 110 to 1060 m²/day and storativity ranges from 1.14×10^{-3} to 4.36×10^{-3} . The depth to water level ranges from 11.41 to 63.05 m bgl during pre monsoon period and 6.74 to 62.15 m bgl during post monsoon period. The long-term water levels trend indicates average fall varies between 0.25m/ year to 1.50 m/year.

GROUND WATER QUALITY:

CGWB has carried out studies for chemical quality of ground water in the area. The ground water of the district is alkaline in nature. Ground water is highly mineralized, alkaline and soft to hard in nature. The electrical conductivity varies from 546 μ mhos cm at 25°C to 1463 μ mhos/ cm at 25°C. The highest value is observed in sample collected from tubewell located in north-eastern part of the city. The southern part of the Rewari city has highle saline groundwater and EC is more than 2000 μ mhos/cm at 25°C. It indicates that shallow groundwater is not suitable for drinking purposes due to constituents more than permissible

limits. Nitrate ranges from 24 to 180 mg/l, fluoride from 0.11 to 0.55 mg/l, & As from 0.0003 to .0083 mg/l in the district.

GROUND WATER RESOURCES:

The blockwise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 44% (Bawal) to 204% (Khol). The net ground water resource of Rewari district have been estimated to be 283.92 MCM and the gross ground water draft of the district is 321.15 mcm leaving behind a shortfall of (-)37.33 MCM. The stage of ground water development in the district is 113%. The ground water development in four blocks of the district has exceeded the available recharge and thus all the 4 blocks (Bawal, Khol, Nahar, Rewari) have been categorized as “over exploited”.

Net ground water availability of the district is 283.92 million cubic meter (mcm), ground water draft for all users is 321.15 mcm, whereas net ground water availability for future irrigation development is -37.33 mcm.

GROUND WATER IRRIGATION SCENARIO

As per the data available from minor irrigation census 2006-07 the detailed number of shallow, deep, tubewells, lined, unlined water distribution system, land holdings of wells are given below for reference

Distribution of Shallow Tubewells According to Owner's Holding Size

No. of shallow tube wells by size class of individual owner							
Sr.no	District	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Others	Total
1	Rewari	24	930	3559	81	13361	17955

Distribution of Deep Tubewells According to Owner's Holding Size

No. of deep tube wells by size class of individual owner							
Sr.no	district	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Big (>=10 ha)	Total
1	Rewari	16	46	161	147	671	1041

Distribution of Shallow Tubewells According to Depth of tube well

No. by the depth of shallow Tube well							
Sr.no	district	(0-20 mts)	(20-40 mts)	(40-60 mts)	(60-70 mts)	(>70 mts)	Total
1	Rewari	0	0	16073	1882	0	17955

Number of Irrigation tube wells with water distribution System

Ground Water Schemes according to water Distribution System				
Open Water Channel				
Sr.no	District	Lined/pucca	Unlined/kutchha	Total
1	Rewari	18515	481	18996

PLAN OF THIS REPORT

In this plan 2 types of the recharge structures are proposed such as Roof Top Rain water harvesting in rural & urban areas and Recharge pits in agriculture lands of 5mt x5mt x3mt size. The pit will be surrounded by angle irons and barbed fencing. The size and depth depend on the availability of the land. The extra water available on the field will be stored in the pit and that will also be recharged to the ground water.

A summary outline of the artificial recharge plan for the entire district of each block is given at the beginning in tabular forms. This is followed by the salient features of each block along with the detailed structure-wise recharge plan and cost estimates.

Details of the block wise type of suitable recharge structures and volume of water assured for annual recharge for each block, schematic design of recharge structures are annexed at annexure I & II.

This plan is focusing on the technical aspects of the ground water recharge through various means so that various implementing agencies may get the appropriate technical guidelines. The existing/ongoing schemes of the central or state govt. like MANERGA, IWSP, PMKVY and NABARD funded schemes, Urban Development schemes, departmentally funded projects etc. may be benefitted from the recharge plan by incorporating the input in the operational guidelines/ design and for locating the specific sites.

Agriculture University, engineering Collages, Academic and Research Institution, NGO may also take up the pilot or demonstrative projects in the blocks suitable to them to plan at local level as per local conditions.

A. POTENTIAL FOR REDUCTION IN OVERDRAFT AFTER RAINWATER HARVESTING AND ARTIFICIAL RECHARGE

Sr.no.	Type of Structure	No. of structures	Unit cost in Lakhs	Total cost of structure in Crores	Annual Recharge (MCM)
ROOF TOP RAIN WATER HARVESTING IN RURAL AND URBEN AREAS					
1	Artificial Recharge Plan For Urban Areas.	4774	0.25	11.94	0.481
2	Roof Top Rain Water Harvesting in Rural Areas	10429	0.25	26.07	0.630
	Total	15203	0.25	38.01	1.111
ARTIFICIAL RECHARGE IN FARMS					
3	Artificial Recharge Plan Through Recharge Pits.	17954	0.35	62.84	12.773
Grand Total				100.85	13.884

A-1 ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF REWARI DISTRICT							
Block	Town Name	Total Households	Total Population of Town	Households taken for AR 10%	Total Roof Top Area (200 sqm) in cluster of 4-6 houses	Cost of recharge at @0.25lacs (Crores) (4*0.25/100)	Vol of water available for recharge (MCM)
1	3	2	3	4	5	6	7
NAHAR	Bhakali (165) (CT)	2010	9970	201	40200	0.50	0.012
REWARI	Dharuhera (MC)	6571	30344	657	131420	1.64	0.069
REWARI	Rewari (M CI)	28702	143021	2870	574040	7.18	0.303
REWARI	Aakera (292) (CT)	1778	7110	178	35560	0.45	0.019
REWARI	Ghatal Mahaniawas (291) (CT)	1396	6005	140	27920	0.35	0.015
REWARI	Maheshari (293) (CT)	2127	9180	213	42540	0.53	0.022
REWARI	Rampura (132) (CT)	1211	5954	121	24220	0.30	0.013
KHOL AT REWARI	Manethi (28) (CT)	987	5070	99	19740	0.25	0.005
BAWAL	Bawal (MC)	2962	16776	296	59240	0.74	0.023
		47744	27800	4774	103200	11.94	0.481

A-2, ROOFROP RAINWATER HARVESTING IN RURAL AREAS OF REWARI DISTRICT								
Name of District	Sr.no	Name of CD Block	Total area of the village (in hectares rounded up to one decimal place)	Number of households (2011 census)	No of Houses taken for Artificial Recharge (10% of total households)	Total No of AR Structures (one structure for each in 10% of houses)	Total recharge in MCM	Cost of recharge at @0.25 lacs (Crores)
REAWRI	1	Bawal	30956	26688	2669	2669	0.154	6.67
	2	Khol	86404	24034	2403	2403	0.139	6.01
	3	Nahar	23728	21402	2140	2140	0.124	5.35
	4	Rewari	30438	32161	3216	3216	0.186	8.04
		TOTAL	171526	104285	10429	10429	0.630	26.07

A3. ARTIFICIAL RCEHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS OF REWARI DISTRICT					
Block Name	Total area of the village (in hectares rounded up to one decimal place)	16.5%of village area taken for farm recharge(sq m)	Total number of recharge pits (1 recharge pit / hector) for 16.5% area	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall in m/1000000)	Cost of Pit (crores) @Rs.0.35 lakh
BAWAL	30956	51077400	5108	3.693	17.88
KHOL	28689	47336850	4734	2.428	16.57
NAHAR	18728	30901200	3090	1.687	10.82
REWARI	30438	50222700	5022	4.965	17.58
Total	108811	179538150	17954	12.773	62.84
Number of Recharge pits are based on following factors: Availability of Irrigation wells In the farmer land Area of sandy strata at shallow depth identified Type of structure will be recharge pit/ Recharge well(where top three meters is clay) 16.5%of village area taken for farm recharge					

QUANTITATIVE IMPACT

Sr.no	Total Draft (present) (mcm)	Overdraft (mcm)	Additional Recharge through proposed structures (mcm)	Draft Reduced due to Recharge (mcm)	Stage of development (present)	Stage of development after recharge	Reduction in stage of development after recharge
1	321.15	-37.33	13.44	307.71	113%	108.37%	4.63%

By the implementation of the proposed recharge structures there will be a reduction of 4.63% in stage of ground water development as tabulated below

B. POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY OF IRRIGATION TUBE WELLS

The micro level transformation in the ground water management have vast impact potential to counter extensive ground water depletion faced by the state of Haryana, particularly in overexploited blocks.

There are around 2495 (out of 18996) tubewells (13%) operated by farmers for irrigation through unlined/Katcha open channel system in Rewari district where water from the tubewell is discharge to the agricultural field. In this process huge (upto 30 %) quantity of ground water is wasted in soil moisture and evaporation losses.

Around 94% of the tube wells are of shallow depth (< 70m) and remaining are deeper (70-110 m) depth. Thus majority of wells are tapping Aquifer group-1 which is under stress due to overexploitation.

Dynamic ground water resources (2011) indicate that Gross ground water draft for irrigation in Rewari district is estimated at 319.99 MCM. It is expected that around 30% of over draft can be brought down by switching over to underground/surface pipeline based distribution from the prevailing unlined open channels. Thereby gross irrigation draft will be reduced to the tune of 305.22 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in the district where four blocks are categorized as overexploited. The measure if implemented will bring down the stage of ground water development from 113 % to 108 %. The category of the blocks will also improve drastically resulting in boosting of agriculture and industrial development otherwise not sustainable in majority of the blocks in the state.

The tubewells also consume enormous electricity which is subsidized and government incurs significant revenue on this account. The measures therefore will result in saving of energy and money. Pollution impact will be reduced whenever diesel engines are used by the farmers. The environmental and ecological condition in the irrigated land will improve. Unwanted weed growth will also be controlled inside the farm land. This will also be useful in the waterlogged/ shallow water table areas as the seepage losses in these areas also aggravate the water logging. **Government should make/launch a mission mode program for installing the underground pipe lines instead of having *katcha* channel in the entire Haryana.** Heavy ground water overdraft can be reduced by these efforts. This will ensure **more crop per drop.**

QUANTITATIVE REDUCTION IN OVERDRAFT AFTER ENHANCING GROUND WATER USE EFFICIENCY IN WATER DISTRIBUTION SYSTEM

Net Annual Ground Water Availability (mcm)	Total Draft (present) (mcm)	Gross Irrigation Draft (present) (mcm)	Gross Ground Water Draft for Domestic and industrial supply (mcm)	Percentage of unlined channel	Wastage through unlined channel, (mcm) (Col 3 X Col5 X 0.25 [#])	Potential of Reduced irrigation overdraft (Col3-col6) (mcm)	Gross draft after saving of water (mcm) (Col 7+Col4)	Present Stage of Development (%)	Stage of development afterwards((Col 8/Col1)X100) (%)	Reduction in stage of development after constructing pucca canal (Col9-Col10) (%)
1	2	3	4	5	6	7	8	9	10	11
283.92	321.15	319.99	1.16	13.13	10.47	309.52	310.68	113	109	4

#losses from open kuchha channel are around 25%

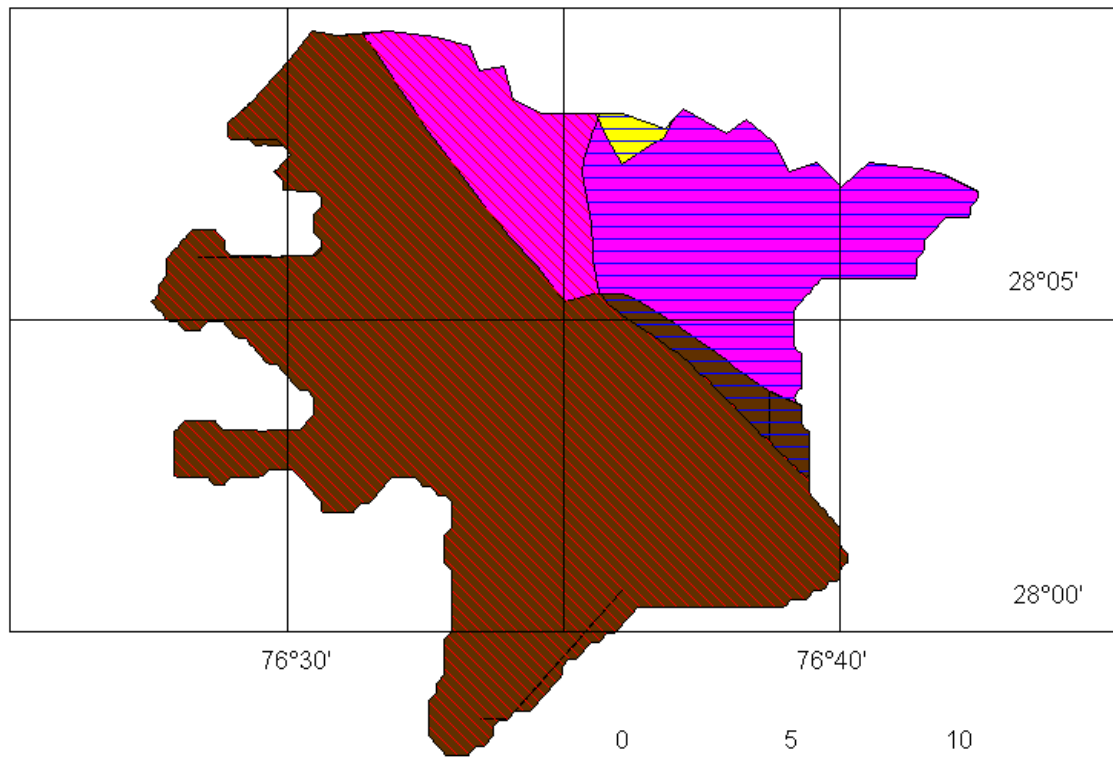
COST ESTIMATE OF UNDERGROUND PIPE LINE

District	Block	Irrigated area by ground water scheme (ha)	Percentage of Unlined Channel (%)	Area under unlined Channels (ha)	Total cost @Rs.0.50 lack per hecter(in cr) =Total irrigated area (by ground water scheme) of the block *0.5 *Col5	Total Cost in Rs. Cr. District wise
1	2	3	4	5	6	7
Rewari	Bawal	19279	13.13	2526	12.63	52.56
	Khol	16967	13.13	2223	11.11	
	Nahar	18728	13.13	2453	12.27	
	Rewari	25271	13.13	3311	16.55	

***BLOCK WISE PLAN OF
DISTRICT REWARI
HARYANA***

(4 OE BLOCKS)

BLOCK-BAWAL DISTRICT-REWARI STATE-HARYANA
DEPTH TO WATER LEVEL BALWAL, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)








LEGEND

Decadal Mean Water Level (m.bgl)

Decadal Mean Trend (m)

-  5.00 to 10.00
-  10.00 to 20.00
-  20.00 to 40.00

-  -0.10 to 0.00
-  0.00 to 0.1114

-  2669 No. of Recharge Structures in Rural Villages
-  296 No. of Recharge Structures in Urban Towns
-  5108 No. of Recharge Pits in Agriculture land
-  15 Thickness of Sand

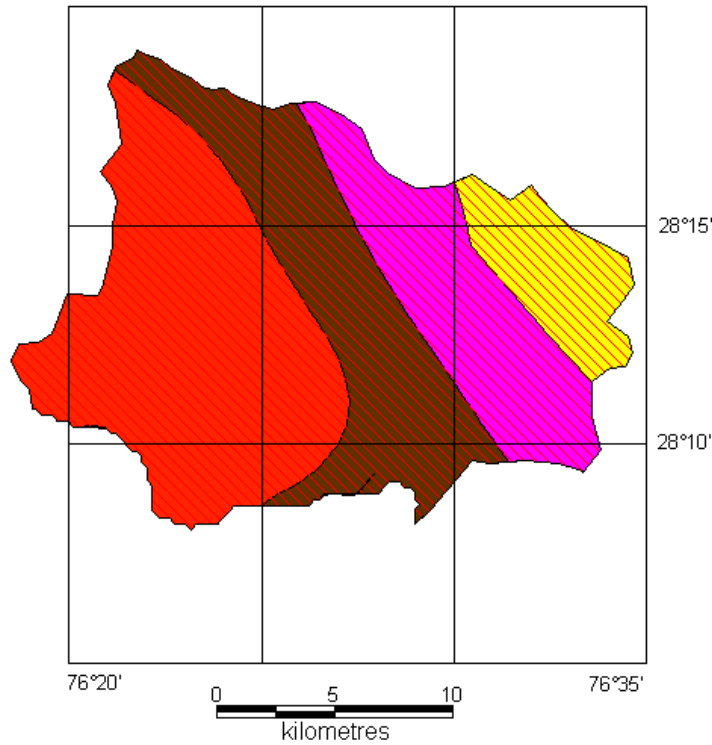
Ground Water Scenario of Block

Block Name:- Bawal District :- Rewari State :- Haryana		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	312.85
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	104 0
	ii) Average Annual Rainfall (mm)	560
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	98
	• Net Area Sown (Sq.Km)	251.80
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	207.84
	• Total Unirrigated Area (Sq.Km)	43.96
4.	PREDOMINANT GEOLOGICAL FORMATIONS	<i>Younger alluvium</i>
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	11.72-26.30 (mbgl)
	• Post –monsoon: (Nov2014)	11.16-26.20 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	4
	• Depth Range (m)	52.20-185.93
	• Discharge (lpm)	560-700/8.6-7.3
	Aquifer Parameters	
	• Transmissivity (m ² /day)	390-536

	<ul style="list-style-type: none"> • Storativity 	$0.12-1*10^{-3}-4.5*10^{-4}$		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> • EC in $\mu\text{S/cm}$ at 25°C 	1463	1554	
	<ul style="list-style-type: none"> • NO₃ (mg/l) 	51	180	
	<ul style="list-style-type: none"> • F (mg/l) 	0.25	0.55	
	<ul style="list-style-type: none"> • Fe (mg/l) 	--	--	
	<ul style="list-style-type: none"> • As (mg/l) 	--	0.0075	
8.	DYNAMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	72.02		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	31.32		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	0.40		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	31.72		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	0.50		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	40.20		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	44		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>	<i>Extensive Irrigation</i>	

9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 15	Percentage % 30	
10	Volume of unsaturated zone available for recharge (MCM)	663		
11.	Volume of water required for recharge (MCM)	841		
12.	Volume of surplus water available for recharge(MCM)	10.87		
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	5108	17.88	3.693
14	RWH Rural @ Rs. 25000/-	2669	6.67	0.154
15	RWH Urban@ Rs. 25000/-	296	0.74	0.023
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2526	12.63	1.03
TOTAL			37.92	4.900




BLOCK-KHOL DISTRICT-REWARI STATE-HARYANA
DEPTH TO WATER LEVEL KHOL, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)








LEGEND

Decadal Mean Water Level (m.bgl)

Decadal Mean Trend (m)

-  5.00 to 10.00
-  10.00 to 20.00
-  20.00 to 40.00
-  > 40.00

-  -0.10 to 0.00

-  No. of Recharge Structures in Rural Villages
-  No. of Recharge Structures in Urban Towns
-  No. of Recharge Pits in Agriculture land
-  Thickness of Sand

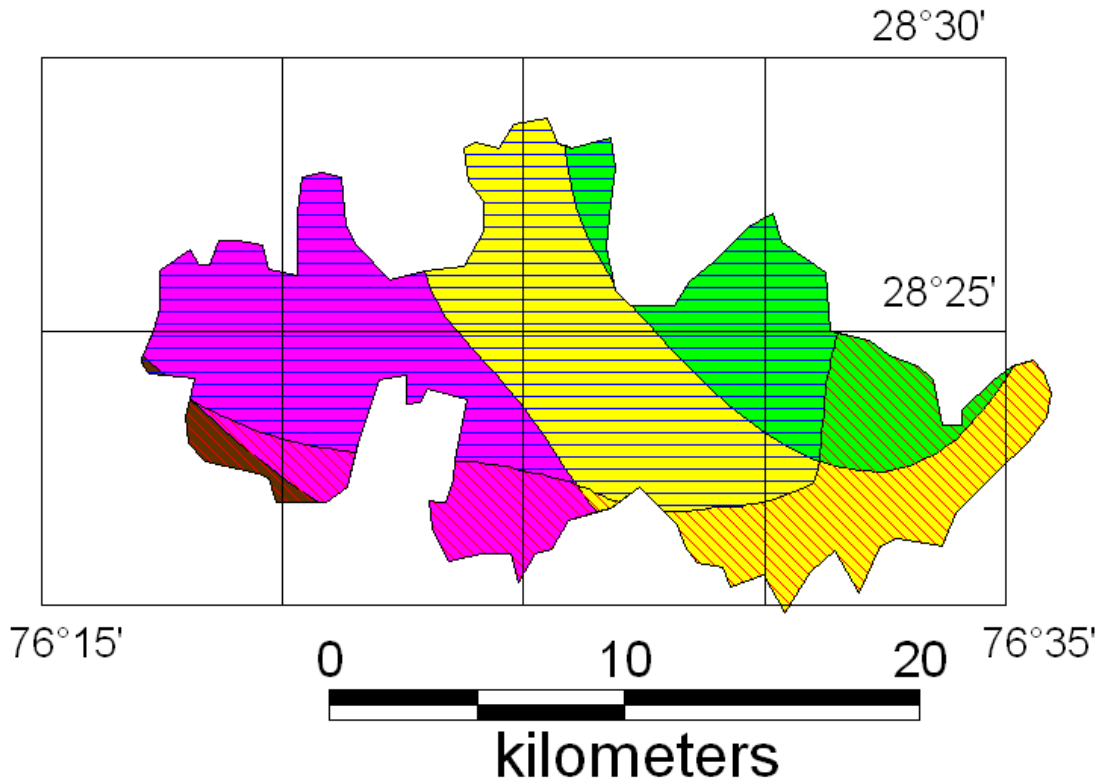
Ground Water Scenario of Block

Block Name:- Khol District :- Rewari State :- Haryana		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	275.24
	<ul style="list-style-type: none"> • Number of Villages inhabited 62 • Un-inhabited 0 	
	ii) Average Annual Rainfall (mm)	560
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	0
	• Net Area Sown (Sq.Km)	231.48
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	171.69
	• Total UnIrrigated Area (Sq.Km)	59.79
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	11.41-63.05 (mbgl)
	• Post –monsoon: (Nov2014)	10.55-62.15 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	5
	• Depth Range (m)	52.20-185.93
	• Discharge (lpm)	560-700/8.6-7.3
	Aquifer Parameters	
	• Transmissivity (m ² /day)	390-536
	• Storativity	0.12-1*10 ⁻³ -4.5*10 ⁻⁴











	• Soil infiltration rate mm/ hour	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in $\mu\text{S}/\text{cm}$ at 25°c	546	884	
	• NO3 (mg/l)	24	126	
	• F (mg/l)	0.11	0.25	
	• Fe (mg/l)	--	0.05	
	• As (mg/l)	0.003	0.0083	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	• Net Ground Water Availability (MCM)	29.47		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	59.98		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	0.18		
	• Existing Gross Ground Water Draft for all Uses (MCM)	60.16		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	0.18		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-30.69		
	• Stage of Ground Water Development / Over Draft (%)	204		
	• Category of Block	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>	<i>Extensive Irrigation</i>	
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 19	Percentage % 38	
10	Volume of unsaturated zone available for recharge (MCM)	556		

11.	Volume of water required for recharge (MCM)	740		
12.	Volume of surplus water available for recharge(MCM)	9.56		
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	4734	16.57	2.428
14	RWH Rural @ Rs. 25000/-	2403	6.01	0.139
15	RWH Urban@ Rs. 25000/-	99	0.25	0.005
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2223	11.11	1.97
TOTAL			33.69	4.54

BLOCK-NAHAR DISTRICT-REWARI STATE-HARYANA
DEPTH TO WATER LEVEL NAHAR, DECADAL MEAN POST MONSOON
Vs
DECADAL MEAN TREND POST MONSOON
(2005-2014)



LEGEND

Decadal Mean Water Level (m.bgl)		Decadal Mean Trend (m)			
	0.00 to 5.00		-0.10 to 0.00		No. of Recharge Structures in Rural Villages
	5.00 to 10.00		0.00 to 0.1114		No. of Recharge Structures in Urban Towns
	10.00 to 20.00				No. of Recharge Pits in Agriculture land
	20.00 to 40.00				Thickness of Sand

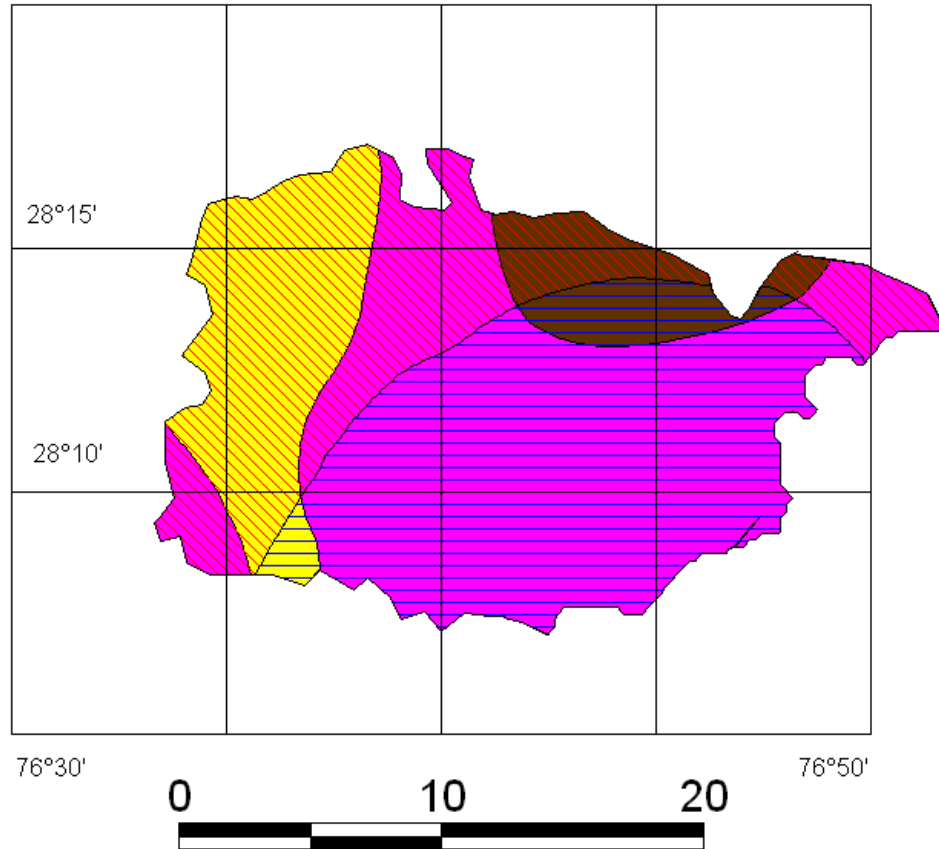
Ground Water Scenario of Block

Block Name:- Nahar District :-Rewari State :- Haryana		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	285.32
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	46 0
	ii) Average Annual Rainfall (mm)	560
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	<i>Ganga Yamuna</i>
3.	LAND USE	
	• Current fallows (Sq.Km)	--
	• Net Area Sown (Sq.Km)	202.56
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	201.41
	• Total UnIrrigated Area (Sq.Km)	115
4.	PREDOMINANT GEOLOGICAL FORMATIONS	<i>Younger alluvium</i>
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Depth to water level	
	• Pre- monsoon: (May 2015)	<i>11.72-26.30 (mbgl)</i>
	• Post –monsoon: (Nov2014)	<i>11.16-26.20 (mbgl)</i>
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	4
	• Depth Range (m)	<i>52.20-185.93</i>
	• Discharge (lpm)	<i>560-700/8.6-7.3</i>
	Aquifer Parameters	










	<ul style="list-style-type: none"> • Transmissivity (m²/day) 	390-536		
	<ul style="list-style-type: none"> • Storativity 	0.12-1*10 ⁻³ -4.5*10 ⁻⁴		
	<ul style="list-style-type: none"> • Soil infiltration rate mm/hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min		Max
	<ul style="list-style-type: none"> • EC in μS/cm at 25⁰c 	--		--
	<ul style="list-style-type: none"> • NO3 (mg/l) 	--		--
	<ul style="list-style-type: none"> • F (mg/l) 	--		--
	<ul style="list-style-type: none"> • Fe (mg/l) 	--		--
	<ul style="list-style-type: none"> • As (mg/l) 	--		--
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> • Net Ground Water Availability (MCM) 	58.06		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Irrigation (MCM) 	58.37		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	0.4		
	<ul style="list-style-type: none"> • Existing Gross Ground Water Draft for all Uses (MCM) 	58.41		
	<ul style="list-style-type: none"> • Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	0.4		
	<ul style="list-style-type: none"> • Net Ground Water Availability for Future Irrigation Development (MCM) 	-35		
	<ul style="list-style-type: none"> • Stage of Ground Water Development / Over Draft (%) 	101		
	<ul style="list-style-type: none"> • Category of Block 	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline	<i>Extensive Irrigation</i>	<i>Extensive Irrigation</i>	

	in ground water level			
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 22	Percentage %	44
10	Volume of unsaturated zone available for recharge (MCM)	577		
11.	Volume of water required for recharge (MCM)	767		
12.	Volume of surplus water available for recharge(MCM)	9.91		
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	3090	10.82	1.687
14	RWH Rural @ Rs. 25000/-	2140	5.35	0.124
15	RWH Urban@ Rs. 25000/-	201	0.50	0.012
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2453	12.27	1.92
TOTAL			28.94	3.74

BLOCK-REWARI DISTRICT-REWARI STATE - HARYANA
DEPTH TO WATER LEVEL REWARI, DECADEAL MEAN POST MONSOON
Vs
DECADEAL MEAN TREND POST MONSOON
(2005-2014)



LEGEND

Decadal Mean Water Level (m.bgl)		Decadal Mean Trend (m)		
	5.00 to 10.00		-0.10 to 0.00	 3216 No. of Recharge Structures in Rural Villages
	10.00 to 20.00		0.00 to 0.1114	 4179 No. of Recharge Structures in Urban Towns
	20.00 to 40.00			 5022 No. of Recharge Pits in Agriculture land
				 21.50 Thickness of Sand

Ground Water Scenario of Block

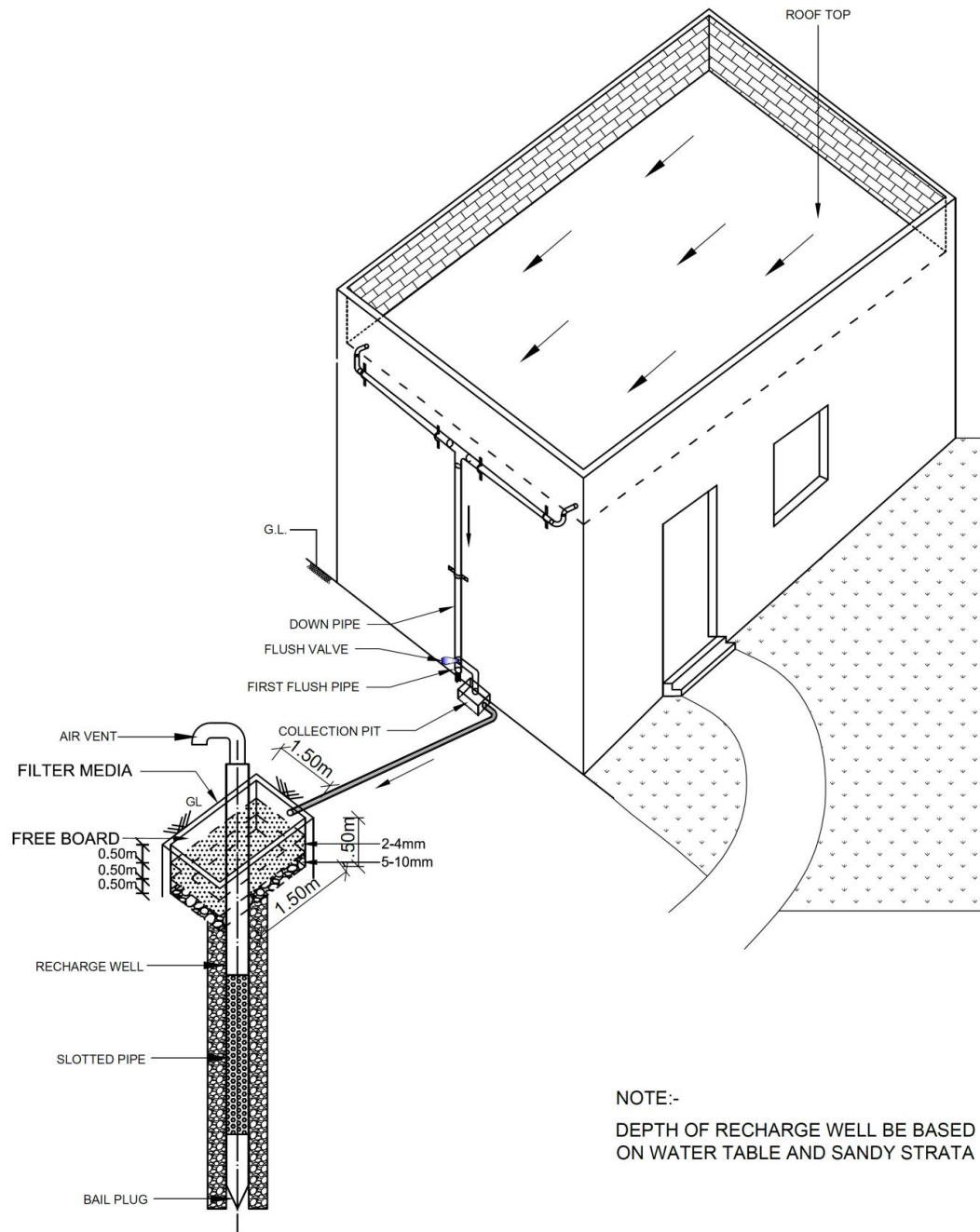
Block Name :- Rewari District :- Rewari State :- Haryana		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	<i>334.34</i>
	<ul style="list-style-type: none"> • Number of Villages inhabited • Un-inhabited 	<i>111</i> <i>6</i>
	ii) Average Annual Rainfall (mm)	<i>659</i>
2.	GEOMORPHOLOGY	
	Major Physiographic	<i>Alluvium Plain</i>
	Major drainages Basin Sub-Basin	<i>Ganga</i> <i>Yamuna</i>
3.	LAND USE	
	• Current fallows (Sq.Km)	<i>2.25</i>
	• Net Area Sown (Sq.Km)	<i>257.56</i>
	• Area Sown More than Once (Sq.Km)	<i>--</i>
	• Total Irrigated Area (Sq.Km)	<i>254.86</i>
	• Total UnIrrigated Area (Sq.Km)	<i>2.70</i>
4.	PREDOMINAT GEOLOGICAL FORMATIONS	<i>Younger alluvium</i>
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	<i>Fine to coarse Sand</i>
	Depth to water level	

	<ul style="list-style-type: none"> Pre- monsoon: (May 2015) 	<i>18.07 – 24.05 (mbgl)</i>		
	<ul style="list-style-type: none"> Post –monsoon: (Nov2014) 	<i>6.74-6.74 (mbgl)</i>		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)			
	<ul style="list-style-type: none"> No of wells drilled 	6		
	<ul style="list-style-type: none"> Depth Range (m) 	<i>153.50 – 203.85</i>		
	<ul style="list-style-type: none"> Discharge (lpm) 	<i>687/8.77</i>		
	Aquifer Parameters			
	<ul style="list-style-type: none"> Transmissivity (m²/day) 	-		
	<ul style="list-style-type: none"> Storativity 	-		
	<ul style="list-style-type: none"> Soil infiltration rate mm/ hour 	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	<ul style="list-style-type: none"> EC in $\mu\text{S}/\text{cm}$ at 25⁰c 	<i>1470</i>	<i>5040</i>	
	<ul style="list-style-type: none"> NO₃ (mg/l) 	<i>20</i>	<i>96</i>	
	<ul style="list-style-type: none"> F (mg/l) 	<i>0.76</i>	<i>1.36</i>	
	<ul style="list-style-type: none"> Fe (mg/l) 	--	--	
	<ul style="list-style-type: none"> As (mg/l) 	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> Net Ground Water Availability (MCM) 	61.73		
	<ul style="list-style-type: none"> Existing Gross Ground Water Draft for Irrigation (MCM) 	105.31		

	<ul style="list-style-type: none"> Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM) 	0.44	
	<ul style="list-style-type: none"> Existing Gross Ground Water Draft for all Uses (MCM) 	105.75	
	<ul style="list-style-type: none"> Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM) 	0.04	
	<ul style="list-style-type: none"> Net Ground Water Availability for Future Irrigation Development (MCM) 	0.44	
	<ul style="list-style-type: none"> Stage of Ground Water Development / Over Draft (%) 	171	
	<ul style="list-style-type: none"> Category of Block 	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<i>Extensive Irrigation</i>	<i>Extensive Irrigation</i>
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 21.5	Percentage % 43
10	Volume of unsaturated zone available for recharge (MCM)	676	
11.	Volume of water required for recharge (MCM)	899	
12.	Volume of surplus water available for recharge(MCM)	11.61	

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	5022	17.58	4.965
14	RWH Rural @ Rs. 25000/-	3216	8.04	0.186
15	RWH Urban@ Rs. 25000/-	4179	10.45	0.441
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3311	16.55	3.46
TOTAL			52.62	9.05

RECHARGE FROM ROOF TOP RAIN WATER HARVESTING (URBAN & RURAL HOUSEHOLDS)



3-D VIEW

CGWB/NWR/Chandigarh

TYPICAL DESIGN FOR RECHARGE PIT IN FARM

