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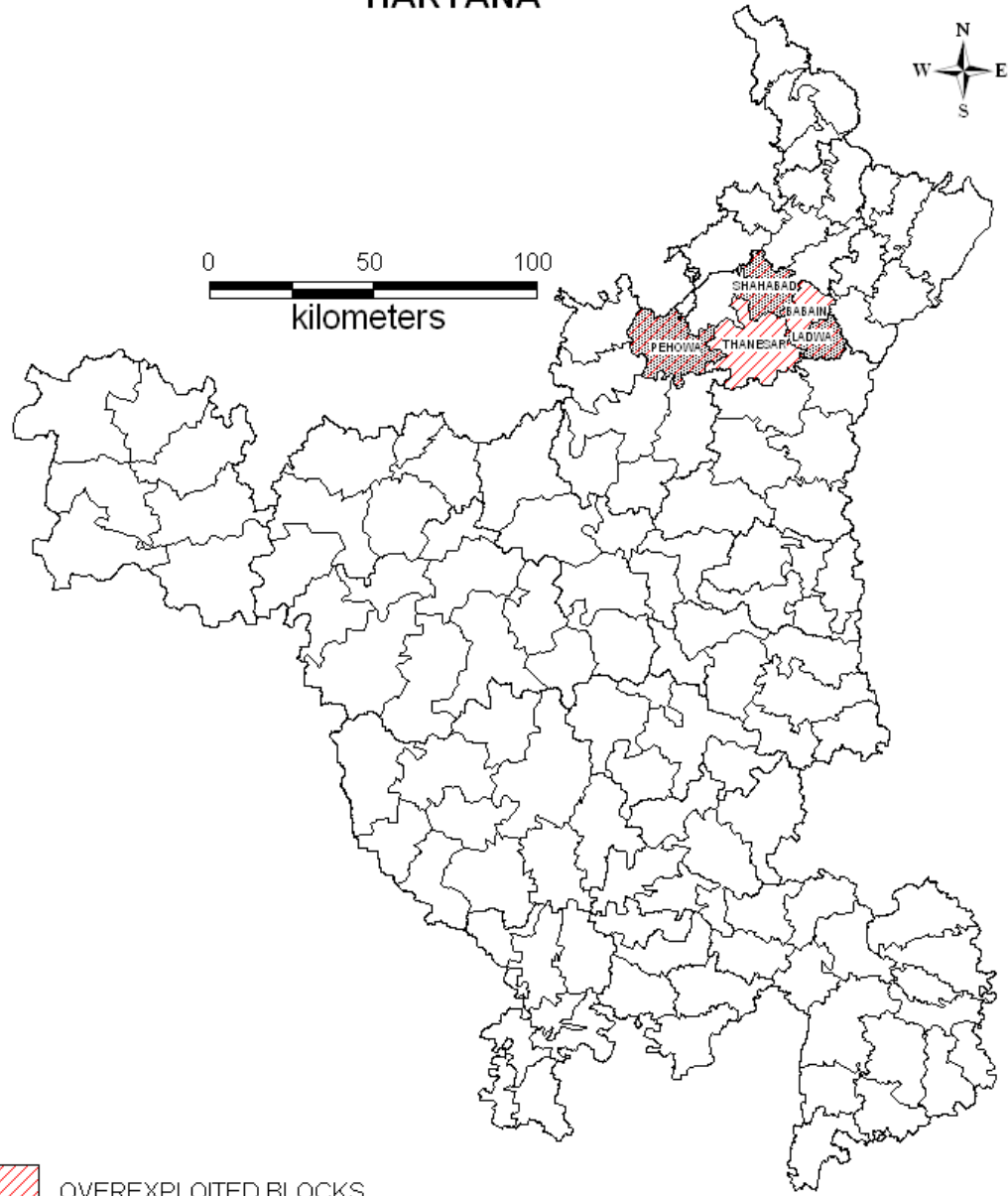
**Government of India  
Ministry of Water Resources,  
River Development & Ganga Rejuvenation  
Central Ground Water Board**

**PLAN ON**

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

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

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



 OVEREXPLOITED BLOCKS

 NOTIFIED BLOCKS

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

## **INTRODUCTION**

Administratively the district comes under Ambala division and it has three tahsils, three sub-tahsils and six blocks. The tahsils are Thanesar, Pehowa and Shahabad and the blocks are Ladwa, Pehowa, Shahabad, Thanesar, Babain and newly created block Ismailabad. The district is well connected by roads and railways. The district headquarter is at Kurukshetra. The main townships are Kurukshetra, Shahabad, Babain, Ladwa and Pehowa. The towns are also well connected by roads. The total population of the district as per 2011 census is 964231.

## **HYDROMETEOROLOGY**

The climate of Kurukshetra district is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrates into the district. The normal annual rainfall of the district is 582 mm which is unevenly distributed over the area. The south west monsoon, sets in from last week of June and withdraws in end of September, contributed about 81% of annual rainfall. July and August are the wettest months. Rest 19% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. In general, rainfall in the district increases from southwest to northeast.

## **GEOMORPHOLOGY**

The area represents almost flat alluvial plain without any conspicuous topographical features. It forms a part of the vast Indo-Gangetic alluvial plains. The average elevation of the plain varies from 274 to 241 m above mean sea level. The general slope of the land is from north-east to south-west wards. The district falls in two basins i.e Upper-Ghaggar Basin and the Upper Yamuna Basin. A small portion in south-east part of the district falls in Upper Yamuna basin and the rest of the area falls in Upper Ghaggar basin. The district is devoid of any perennial river. The only river Markanda flows in the north-western part of the district which originates in Nahan hills. The river flows in south western direction. The other geomorphological features of the district are Chautang, Khad and Omla nals are of local existence which drains the district.

The entire district of Kurukshetra is covered by tropical arid brown soils. These soils are very pale brown in colour. They do not have well defined horizons. In general these soils are deep and imperfectly drained. The permeability of these soils is low to moderate. These soils are mildly alkaline to strongly alkaline in reaction. The available moisture holding capacity of these soils is medium to high. These soils are medium to high in organic matter. Three soil types viz sandy loam, loam and clay loam are commonly met within this group. Rainfall and seepage, canal networks and irrigation is the principal source of ground water recharge in the area.

### **HYDROGEOLOGY**

The area falls in the Upper Yamuna and Ghaggar Basins. The district is occupied by geological formations of Quaternary age comprising of Recent alluvial deposits belong to the vast Indus alluvial plains. Ground water at shallow depth occurs under unconfined and semi confined condition and under confined conditions in deeper aquifers.

Central Ground Water Board has drilled 05 exploratory wells and 35 piezometers through in-house and 09 PZs through outsourced by M/s WAPCOS Ltd. to delineate and determine the potential aquifer zones, evaluation of aquifer characteristics etc. The drilling has been done to a maximum depth of about 463 m and revealed the presence of 3 to 9 prominent permeable granular zones with aggregate thickness varying from 31 to 203 m. The granular zones consists of fine to coarse sand, occasional gravel and pebble.

Further, the study of exploratory boreholes drilled in the district revealed the presence of three distinct aquifer groups up to the maximum drilled depth of 450 m. The first aquifer groups forms the water table aquifer and occurs down to 115 m below ground level. The second aquifer occurs in the depth range of 65 to 283 m depth which behaves as semi-confined to confined and consisting of individual sand and clay layers. The third one exist between 197 and 346 m depth and occurs in confined condition and consisting of thin sand layers alternating with thicker clay layer. The thickness of the alluvium is presumed to be more because bedrock has not been encountered up to 450 m depth in the district.

The aquifer parameters were also determined during the ground water exploration work. The discharge of 5 exploratory wells constructed varies from 1374 to 4140 lpm for a draw-

down of 3 to 6m. The transmissivity value ranges from 830 to 2424m<sup>2</sup>/day. The storage coefficient values ranges from 1.38x10<sup>-3</sup> to 6.6x10<sup>-4</sup>. In the eastern part of the district which falls in the Upper Yamuna Basin, the following aquifer parameters were obtained:

Aquifer Group		Average Transmissivity (m <sup>2</sup> /day)	'K' (Lateral)	Storativity
I	Unconfined	2,200	24	0.12
II	Semi-confined	700	7.2	1x10 <sup>-3</sup>
III	Confined	525	7.1	4.5x10 <sup>-4</sup>

#### **WATER LEVEL BEHAVIOR**

Depth to water level in the district ranges from 19.90 m to 46.01 m bgl during pre monsoon period ,2015 and 19.83 m to 41.58 m bgl during post monsoon period 2014. The depth to water level map indicates that in major part of the district water level rest more than 30 m bgl and spreads in Shahabad, Babain, Ladwa blocks and parts of Thanesar block. The shallow water levels in the depth range of 20 to 25 m bgl spreads in southern and western parts of the district covering Thanesar and Pehowa Blocks. It has also been observed that during post monsoon period the area between 20m to 25 m bgl gets reduced and area under more than 30 m bgl gets spreads indicating stress on ground water to meet out the agricultural demand not only during monsoon season but also in non-monsoon period.

#### **GROUND WATER QUALITY:**

Chemical data of ground water from shallow aquifer indicates that ground water is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are less than 1000 µS/cm, except at Ishaq where the EC value is 1920 µS/cm at 25°C. Generally it is suitable for drinking purposes as chemical parameters are well within the permissible limits for safe drinking water set by Bureau of Indian standard (BIS) except for fluoride at Ishaq (2.76 mg/l) and heavy metals at few places. These places are Ishaq (Fe- 2.86 mg/l), Salpanikalan (Lead- 0.20 mg/l), Jhansa (Zn- 15.38 mg/l), Yara (Fe- 1.97 mg/l), Tatka (Fe- 1.45 mg/l) and mathana (Fe 1.68 mg/l), Among anions, bicarbonate is the dominant anion and among cations, either either sodium is the dominant cation (45%) or mixed cationic character prevails.

The USSL diagram used for classification of irrigation water indicates that ground water fall under C<sub>2</sub>S<sub>1</sub> and C<sub>3</sub>S<sub>1</sub> classes and is therefore suitable for customary irrigation on well drained soils.

Type of water: Na-HCO<sub>3</sub> type and Mixed cation-HCO<sub>3</sub> type.

**GROUND WATER RESOURCES:**

Block-wise ground water resource potential of the district has been assessed as per GEC-97 as on 31<sup>st</sup> March 2011. The ground water development in all the blocks has exceeded the available recharge, thus all the blocks have been categorized as over exploited. Stage of ground water development ranges from 201% (block-Pehowa) to 361% (block-Ladwa). Net annual replenishable ground water availability in the district have been assessed as 353.33 MCM. The total ground water draft for all uses in the district is 778.36 MCM, thus leaving short-fall (over draft) of 425.03 MCM. Stage of ground water development in the Kurukshetra district has been assessed to be 220%. The block-wise ground water resource potential as on 31<sup>st</sup> March 2011 in the district are as follows:-

### GROUND WATER IRRIGATION SCENARIO

Block	Net Annual Ground Water Availability (ham)	Existing Gross Ground Water Draft for irrigation (ham)	Existing Gross Ground Water Draft for domestic and industrial water supply (ham)	Existing Gross Ground Water Draft for all users (ham)	Allocation for domestic and industrial requirement supply upto next 25 years (ham)	Net Ground Water availability for future irrigation development (ham)	Stage of ground water development (%)	Category of Block
Babain	3116	6444	723	7167	723	-4051	230	<b>Over Exploited</b>
Ladwa	3096	10051	1126	11177	1126	-8081	361	<b>Over Exploited</b>
Pehowa	9664	18084	1337	19421	1337	-9757	201	<b>Over Exploited</b>
Shahabad	7386	14210	1157	15367	1157	-7981	208	<b>Over Exploited</b>
Thaneswar	12071	22310	2394	24704	2394	-12633	205	<b>Over Exploited</b>
<b>Total</b>	<b>35333</b>	<b>71099</b>	<b>6737</b>	<b>77836</b>	<b>6737</b>	<b>-42503</b>	<b>220</b>	

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 Tubewells According to Owner's Holding Size

Sr.no	District	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Public	Group of Farmers	Total
<b>1</b>	<b>Kurukshetra</b>	<b>91</b>	<b>1851</b>	<b>5875</b>	<b>1475</b>	<b>630</b>	<b>22618</b>	<b>32540</b>

#### 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
<b>1</b>	<b>Kurukshetra</b>	<b>0</b>	<b>26092</b>	<b>2852</b>	<b>0</b>	<b>3596</b>	<b>32540</b>

## Number of Ground Water Schemes and Potential Utilized by water distribution device

Ground Water Schemes according to water Distribution System				
Open Water Channel				
Sr.no	District	Lined/pucca	Unlined/kutcha	Total
1	Kurukshetra	27357	5183	32540

### 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 5m x 5m x 3m 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 summery 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 is also given. 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, 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 OVER DRAFT 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)
<b>ROOF TOP RAIN WATER HARVESTING IN RURAL AND URBEN AREAS</b>					
1	Artificial Recharge Plan For Urban Areas.	5732	0.25	14.33	0.257
2	Roof Top Rain Water Harvesting in Rural Areas	13082	0.25	32.71	8.134
	<b>Total</b>	<b>18814</b>	<b>0.25</b>	<b>47.04</b>	<b>8.391</b>
<b>ARTIFICIAL RECHARGE IN FARMS</b>					
1	Artificial Recharge Plan Through Recharge Pits.	16107	0.35	56.37	11.89
			<b>Total</b>	<b>103.41</b>	<b>20.281</b>

By the implementation of the proposed recharge structures there will be a reduction of 5.45% in stage of ground water development as tabulated below

Sr.no.	Total Draft (present) (mcm)	Recharge through different proposed structures (mcm)	Draft Reduced due to Recharge (mcm)	Stage of development (present) (Average value of three OE Blocks)	Stage of development after recharge	Reduction in stage of development after recharge
1	778.3	20.281	758.079	220%	214.55%	5.45%

**ARTIFICIAL RECHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS OF KURUKSHETRA DISTRICT**

DISTRICT NAME	Block Name	Total area of the village (in hectares rounded up to one decimal place)	10%of village area taken for farm recharge (sq m)	Total number of recharge pits (1 recharge pit / hector) for 10% area	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall in m/1000000)	Cost of Pit @Rs.0.35 in Crores
KURUKSHETRA	Babain	13386	1339	1339	0.988	4.69
	Ladwa	18247	1825	1825	1.347	6.39
	Pehowa	48285	4828	4828	3.563	16.90
	Shahbad	34740	3474	3474	2.564	12.16
	Thaneswar	46414	4641	4641	3.425	16.24
	<b>Total</b>		<b>161072</b>	<b>16107</b>	<b>16107</b>	<b>11.887</b>

**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)

**ROOF TOP RAINWATER HARVESTING IN RURAL AREAS OF KURUKSHETRA DISTRICT OF HARYANA**

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 10 house holds)	Total recharge in MCM	Cost @0.25 in Crores
1	Babain	13386	11584	1158	1158	0.684	2.90
2	Ladwa	18247	16592	1659	1659	1.250	4.15
3	Pehowa	48285	30935	3094	3094	1.280	7.74
4	Shahbad	34740	29344	2934	2934	1.730	7.34
5	Thaneswar	46414	42369	4237	4237	3.190	10.59
	<b>Total</b>	<b>161072</b>	<b>130824</b>	<b>13082</b>	<b>13082</b>	<b>8.134</b>	<b>32.72</b>

**ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF KURUKSHETRA DISTRICT, HARYANA**

District	Name of CD Block	Town Name	Total Households	Total Population of Town	Housholds taken for Atificial Recharge (10%)	Total Roof Top Area (sqm)	Vol of water available for recharge (MCM)	Cost of recharge st @0.25 lac (in Crores)
<b>KURUKSHETRA</b>	SHAHBAD	Shahbad (MC)	9222	42607	922	92220	0.036	2.31
	PEHOWA	Pehowa (MC)	7831	38853	783	78310	0.022	1.96
	SHAHBAD	Ismailabad (317)(CT)	2752	13726	275	27520	0.011	0.69
	THANESAR	Thanesar (M CI)	31689	155152	3169	316890	0.159	7.92
	LADWA	Ladwa (MC)	5825	28887	583	58250	0.029	1.46
	<b>TOTAL</b>				<b>5732</b>		<b>0.257</b>	<b>14.34</b>

## **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 5183 operated by farmers for irrigation through unlined/Katcha (15.93%) open channel system in Kurukshetra district where water from the tubewell is discharge to the agricultural field. In this process huge quantity of ground water is wasted in soil moisture and evaporation losses.

Dynamic ground water resources (2011) indicate that Gross ground water draft for irrigation in Kurukshetra district is estimated at 710.99 MCM. It is expected that around 7.72% of over draft can be brought down by switching over to underground/surface pipeline based distribution from the prevailing unlined open channels. Thereby gross draft will be reduced to the tune of 28.32 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks of Ambala Districts. The measure if implemented will bring down the ground water overdraft from 220% to 212.28 %. 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.**

**POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY IN IRRIGATION TUBEWELLS, KURUKSHETRA DISTRICT**

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 Col 5 X 0.25 <sup>#</sup> )	Potential of Reduced irrigation overdraft (Col 3 - Col 6) (mcm)	Gross draft after saving of water (mcm) (Col 7 + Col 4)	Present Stage of development (%)	Stage of development afterwards ((Col 8/Col 1) X 100) (%)	Reduction in stage of development after constructing pucca channel (Col 9 - Col 10) (%)
1	2	3	4	5	6	7	8	9	10	11
353.33	778.36	710.99	67.37	15.93	28.32	682.68	750.05	220	212.28	7.72

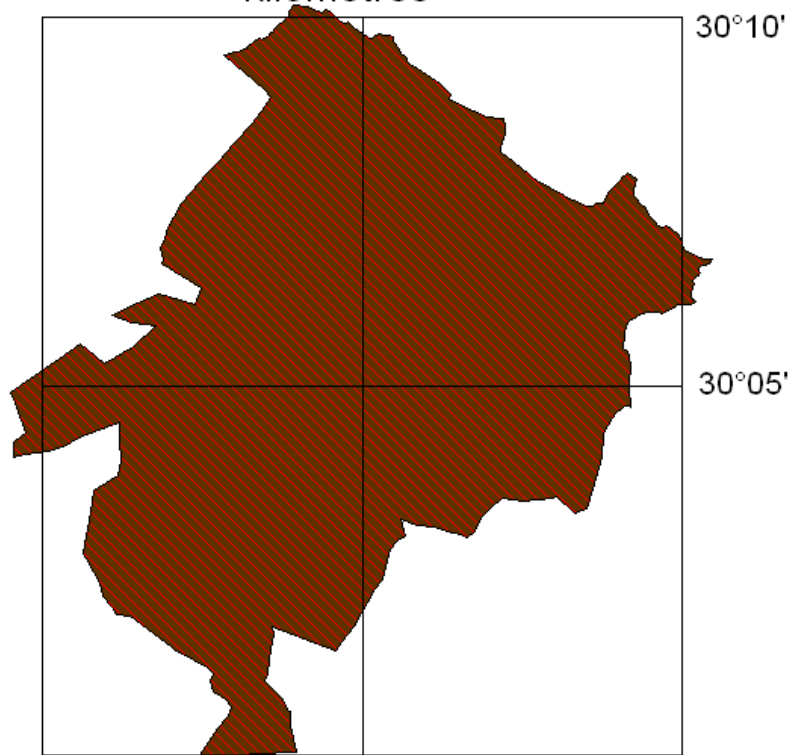
*#losses from open kuchha channel are around 25%.*

**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 lakh per hectore (in cr) Area *0.50/100 = Crores	Total Cost in Rs. Cr. District wise
<b>KURUKSHETRA</b>	Babain	11967	15.93	1906	9.53	<b>105.20</b>
	Ladwa	16193	15.93	2580	12.90	
	Pehowa	35083	15.93	5589	27.94	
	Shahbad	30054	15.93	4788	23.94	
	Thaneswar	38782	15.93	6178	30.89	

***BLOCK  
WISE PLAN OF  
DISTRICT  
KURUKSHETRA  
HARYANA  
  
(5 OE BLOCKS)***

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



**LEGEND**    76°55'

77°05'

Decadal Mean Water Level (m.bgl)


 20.00 to 40.00

Decadal Mean Trend (m)

 -0.10 to 0.00

 1158 No. of Recharge Structures in Rural Villages

 0 No. of Recharge Structures in Urban Towns

 1339 No. of Recharge Pits in Agriculture land

 15 Thickness of Sand

### Ground Water Scenario of Block

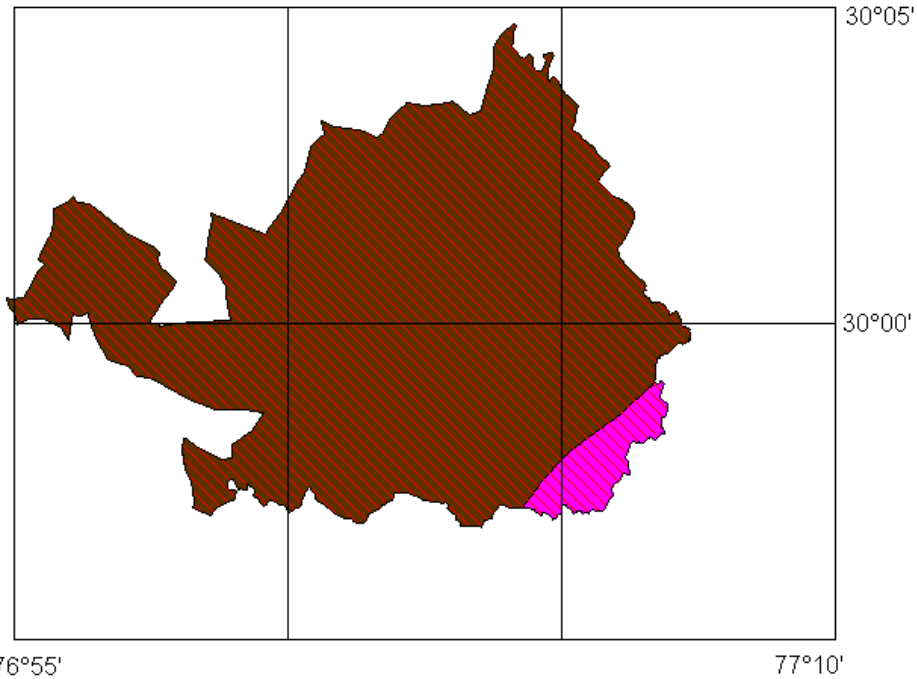
<b>Block Name:- Babain</b> <b>District :-Kurukshetra</b> <b>State :- Haryana</b>		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	167.84
	<ul style="list-style-type: none"> <li>• Number of Villages inhabited</li> <li>• Un-inhabited</li> </ul>	49 0
	ii) Average Annual Rainfall (mm)	580
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	Ganga Yamuna
3.	LAND USE	
	• Current fallows (Sq.Km)	0
	• Net Area Sown (Sq.Km)	119.67
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	119.67
• Total Unirrigated Area (Sq.Km)	--	
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	36.33-36.33 (mbgl)
	• Post –monsoon: (Nov2014)	36.12-.36.12 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	2
	• Depth Range (m)	50-463



	<ul style="list-style-type: none"> <li>Discharge (lpm)</li> </ul>	1374-4140/3 to 6		
	Aquifer Parameters			
	<ul style="list-style-type: none"> <li>Transmissivity (m<sup>2</sup>/day)</li> </ul>	2200/700-525		
	<ul style="list-style-type: none"> <li>Storativity</li> </ul>	$0.12-1*10^{-3}-4.5*10^{-4}$		
	<ul style="list-style-type: none"> <li>Soil infiltration rate mm/hour</li> </ul>	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	VALUES		
	<ul style="list-style-type: none"> <li>EC in <math>\mu\text{S}/\text{cm}</math> at 25<sup>0</sup>c</li> </ul>	640		
	<ul style="list-style-type: none"> <li>NO<sub>3</sub> (mg/l)</li> </ul>	18		
	<ul style="list-style-type: none"> <li>F (mg/l)</li> </ul>	0.27		
	<ul style="list-style-type: none"> <li>Fe (mg/l)</li> </ul>	--		
	<ul style="list-style-type: none"> <li>As (mg/l)</li> </ul>			
8.	DYANMIC GROUND WATER RESOURCES in MCM	<b>2011</b>		
	<ul style="list-style-type: none"> <li>Net Ground Water Availability (MCM)</li> </ul>	31.16		
	<ul style="list-style-type: none"> <li>Existing Gross Ground Water Draft for Irrigation (MCM)</li> </ul>	64.44		
	<ul style="list-style-type: none"> <li>Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)</li> </ul>	7.23		
	<ul style="list-style-type: none"> <li>Existing Gross Ground Water Draft for all Uses (MCM)</li> </ul>	71.67		
	<ul style="list-style-type: none"> <li>Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)</li> </ul>	7.23		
	<ul style="list-style-type: none"> <li>Net Ground Water Availability for Future Irrigation Development (MCM)</li> </ul>	-40.51		
	<ul style="list-style-type: none"> <li>Stage of Ground Water Development / Over Draft (%)</li> </ul>	230		

	<ul style="list-style-type: none"> <li>Category of Block</li> </ul>	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	<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)	457		
11.	Volume of water required for recharge (MCM)	608		
12.	Volume of surplus water available for recharge(MCM)	4.89		
<b>RECHARGE/ CONSERVATION STRUCTURES</b>		<b>Total Number of Recharge Structures</b>	<b>Total Cost (Rs. in crores)</b>	<b>Total Recharge/Water saving in MCM</b>
13	Farm Recharge @Rs. 35000/-	1339	4.69	0.988
14	RWH Rural @ Rs. 25000/-	1158	2.90	0.684
15	RWH Urban@ Rs. 25000/-	0	0	0
16	Underground pipe line (area in hectares) @ Rs. 50000/-	1906	9.53	2.57
<b>TOTAL</b>			<b>17.12</b>	<b>4.242</b>

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




**LEGEND**

Decadal Mean Water Level (m.bgl)

-  10.00 to 20.00
-  20.00 to 40.00

Decadal Mean Trend (m)

-  -0.10 to 0.00

-  1659 No. of Recharge Structures in Rural Villages
-  583 No. of Recharge Structures in Urban Towns
-  1825 No. of Recharge Pits in Agriculture land
-  21 Thickness of Sand

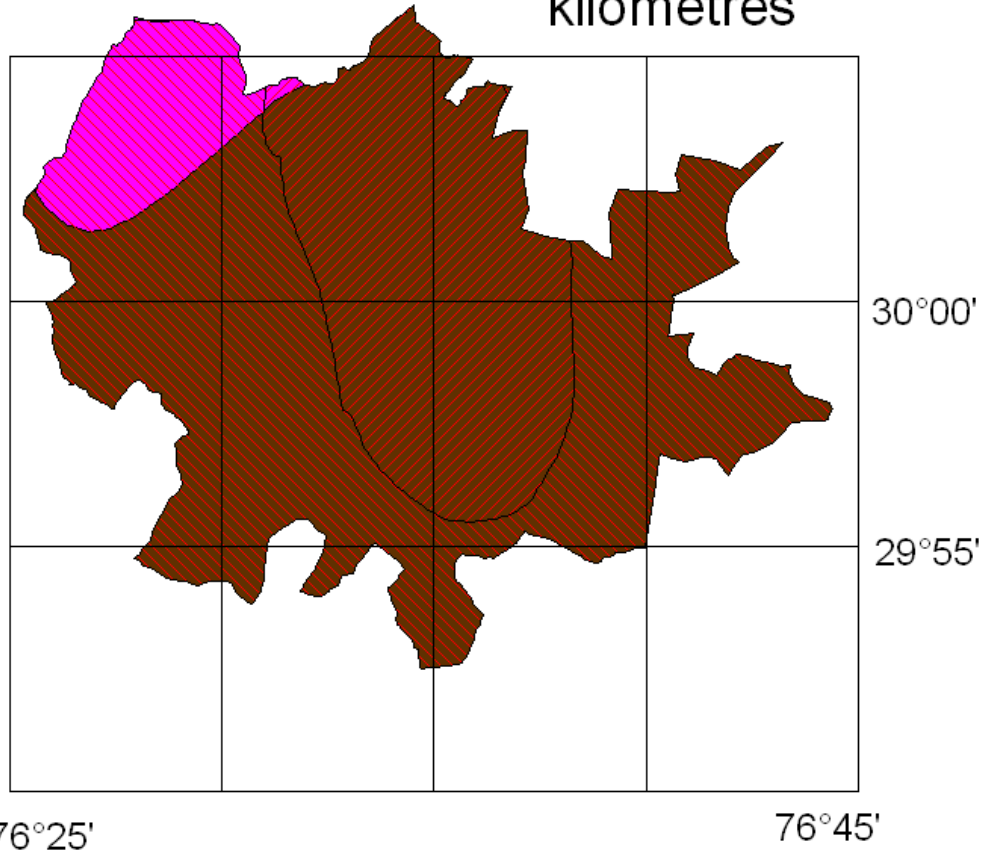
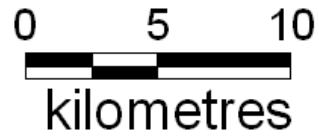
### Ground Water Scenario of Block

<b>Block Name :- Ladwa</b> <b>District :-Kurukshetra</b> <b>State :- Haryana</b>		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	162.30
	<ul style="list-style-type: none"> <li>• Number of Villages inhabited</li> <li>• Un-inhabited</li> </ul>	53 0
	ii) Average Annual Rainfall (mm)	628
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)	161.93
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	161.93
• Total Unirrigated Area (Sq.Km)	0	
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	19.90-19.90 (mbgl)
	• Post –monsoon: (Nov2014)	19.87-35.71 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	4
	• Depth Range (m)	50-463
	• Discharge (lpm)	1374-4140/3 to 6

	Aquifer Parameters			
	• Transmissivity (m <sup>2</sup> /day)	2200/700-525		
	• Storativity	0.12-1*10 <sup>-3</sup> -4.5*10 <sup>-4</sup>		
	• Soil infiltration rate mm/ hour	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in μS/cm at 25 <sup>0</sup> c	--	--	
	• NO3 (mg/l)	--	--	
	• F (mg/l)	--	--	
	• Fe (mg/l)	--	--	
	• As (mg/l)	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	<b>2011</b>		
	• Net Ground Water Availability (MCM)	30.96		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	100.51		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	11.26		
	• Existing Gross Ground Water Draft for all Uses (MCM)	111.77		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	11.26		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-80.81		
	• Stage of Ground Water Development / Over Draft (%)	361		
	• 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>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 21	Percentage % 42	
10	Volume of unsaturated zone available for recharge (MCM)	442		
11.	Volume of water required for recharge (MCM)	588		
12.	Volume of surplus water available for recharge(MCM)	4.73		
<b>RECHARGE/ CONSERVATION STRUCTURES</b>		<b>Total Number of Recharge Structures</b>	<b>Total Cost (Rs. in crores)</b>	<b>Total Recharge/Water saving in MCM</b>
13	Farm Recharge @Rs. 35000/-	1825	6.39	1.347
14	RWH Rural @ Rs. 25000/-	1659	4.15	1.25
15	RWH Urban@ Rs. 25000/-	583	1.46	0.029
16	Underground pipe line (area in hectares) @ Rs. 50000/-	2580	12.90	4.00
<b>TOTAL</b>			<b>24.90</b>	<b>6.63</b>


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




**LEGEND**


Decadal Mean Water Level (m.bgl)

 10.00 to 20.00

 20.00 to 40.00


Decadal Mean Trend (m)


 -0.20 to -0.10

 -0.10 to 0.00

 3094 No. of Recharge Structures in Rural Villages

 783 No. of Recharge Structures in Urban Towns

 4829 No. of Recharge Pits in Agriculture land

 21.5 Thickness of Sand

### Ground Water Scenario of Block

<b>Block Name:- Pehowa</b> <b>District :-Kurukshetra</b> <b>State :- Haryana</b>		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	507
	<ul style="list-style-type: none"> <li>• Number of Villages inhabited</li> <li>• Un-inhabited</li> </ul>	83 0
	ii) Average Annual Rainfall (mm)	346
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)	416.25
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	416.25
	• Total Unirrigated Area (Sq.Km)	0
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	26.39-32.99 (mbgl)
	• Post –monsoon: (Nov2014)	29.87-35.92 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	12
	• Depth Range (m)	50-463
	• Discharge (lpm)	1374-4140/3 to 6



	Aquifer Parameters			
	• Transmissivity (m <sup>2</sup> /day)	2200/700-525		
	• Storativity	0.12-1*10 <sup>-3</sup> -4.5*10 <sup>-4</sup>		
	• Soil infiltration rate mm/ hour	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in μS/cm at 25 <sup>0</sup> c	792	1246	
	• NO3 (mg/l)	ND	ND	
	• F (mg/l)	1.16	1.43	
	• Fe (mg/l)	--	--	
	• As (mg/l)	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	<b>2011</b>		
	• Net Ground Water Availability (MCM)	96.64		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	180.84		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	13.37		
	• Existing Gross Ground Water Draft for all Uses (MCM)	194.21		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	13.37		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-97.57		
	• Stage of Ground Water Development / Over Draft (%)	201		
	• 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>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 21.50	Percentage % 43	
10	Volume of unsaturated zone available for recharge (MCM)	1382		
11.	Volume of water required for recharge (MCM)	1837		
12.	Volume of surplus water available for recharge(MCM)	14.78		
<b>RECHARGE/ CONSERVATION STRUCTURES</b>		<b>Total Number of Recharge Structures</b>	<b>Total Cost (Rs. in crores)</b>	<b>Total Recharge/Water saving in MCM</b>
13	Farm Recharge @Rs. 35000/-	4828	16.90	3.563
14	RWH Rural @ Rs. 25000/-	3094	7.74	1.28
15	RWH Urban@ Rs. 25000/-	783	1.96	0.022
16	Underground pipe line (area in hectares) @ Rs. 50000/-	5589	27.94	7.20
<b>TOTAL</b>			<b>54.54</b>	<b>12.07</b>

**BLOCK-SHAHBAD DISTRICT-KURUKSHETRA STATE-HARYANA  
 DEPTH TO WATER LEVEL SHAHBAD, DECADAL MEAN POST MONSOON**

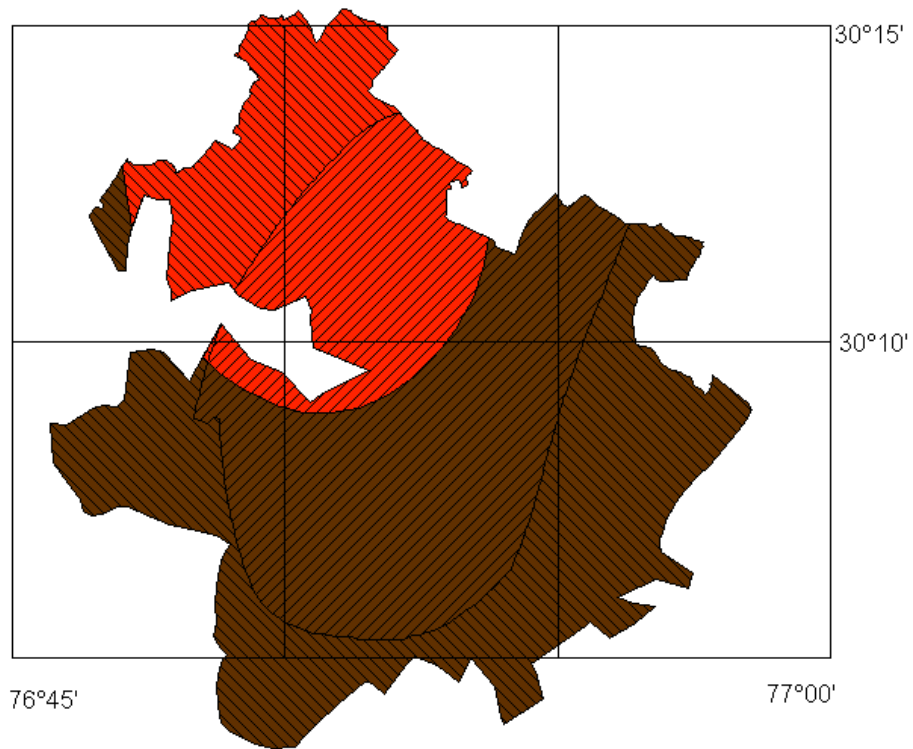
**Vs  
 DECADAL MEAN TREND POST MONSOON  
 (2005-2014)**



0 5 10



kilometres







**LEGEND**

Decadal Mean Water Level (m.bgl)

-  20.00 to 40.00
-  > 40.00

Decadal Mean Trend (m)

-  -0.20 to -0.10
-  -0.10 to 0.00

-  2934 No. of Recharge Structures in Rural Villages
-  1197 No. of Recharge Structures in Urban Towns
-  3474 No. of Recharge Pits in Agriculture land
-  7 Thickness of Sand

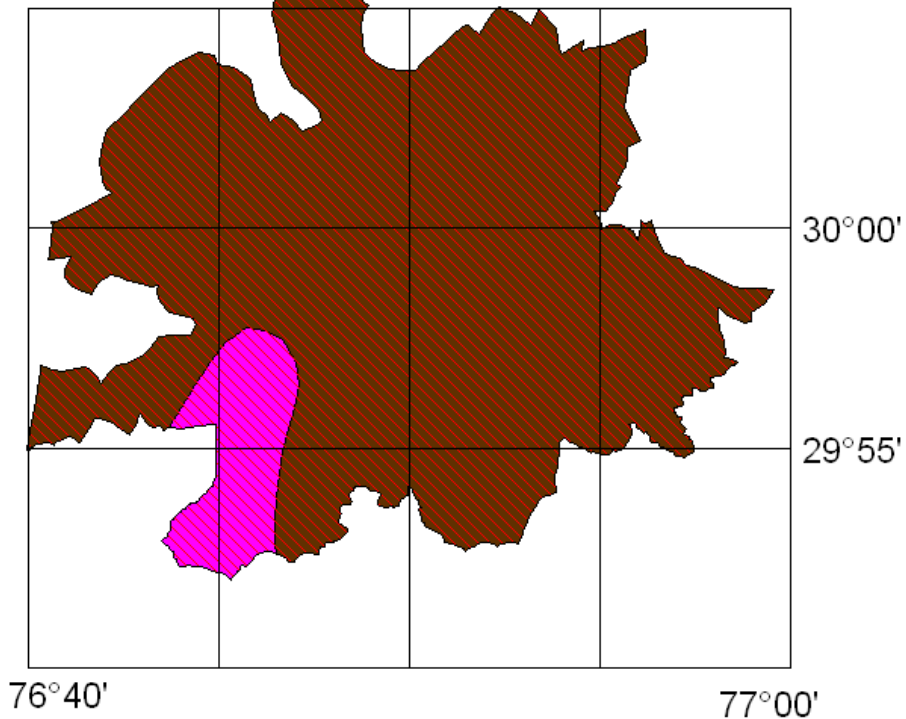
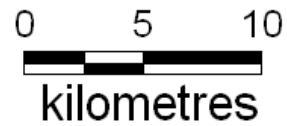
### Ground Water Scenario of Block

<b>Block Name:- Shahbad</b> <b>District :-Kurukshetra</b> <b>State :- Haryana</b>		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	377.12
	<ul style="list-style-type: none"> <li>• Number of Villages inhabited</li> <li>• Un-inhabited</li> </ul>	107 0
	ii) Average Annual Rainfall (mm)	580
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)	308.56
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	308.53
• Total Unirrigated Area (Sq.Km)	--	
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	46.01-46.01 (mbgl)
	• Post –monsoon: (Nov2014)	41.58-41.58 (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	7
	• Depth Range (m)	50-463
	• Discharge (lpm)	1374-4140/3 to 6
	Aquifer Parameters	
• Transmissivity (m <sup>2</sup> /day)	2200/700-525	

	<ul style="list-style-type: none"> <li>• Storativity</li> </ul>	$0.12-1*10^{-3}-4.5*10^{-4}$		
	<ul style="list-style-type: none"> <li>• Soil infiltration rate mm/ hour</li> </ul>	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	VALUE		
	<ul style="list-style-type: none"> <li>• EC in <math>\mu\text{S}/\text{cm}</math> at <math>25^{\circ}\text{c}</math></li> </ul>	570		
	<ul style="list-style-type: none"> <li>• NO<sub>3</sub> (mg/l)</li> </ul>	ND		
	<ul style="list-style-type: none"> <li>• F (mg/l)</li> </ul>	0.41		
	<ul style="list-style-type: none"> <li>• Fe (mg/l)</li> </ul>	--		
	<ul style="list-style-type: none"> <li>• As (mg/l)</li> </ul>	--		
8.	DYANMIC GROUND WATER RESOURCES in MCM	2011		
	<ul style="list-style-type: none"> <li>• Net Ground Water Availability (MCM)</li> </ul>	73.86		
	<ul style="list-style-type: none"> <li>• Existing Gross Ground Water Draft for Irrigation (MCM)</li> </ul>	142.10		
	<ul style="list-style-type: none"> <li>• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)</li> </ul>	11.57		
	<ul style="list-style-type: none"> <li>• Existing Gross Ground Water Draft for all Uses (MCM)</li> </ul>	153.67		
	<ul style="list-style-type: none"> <li>• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)</li> </ul>	11.57		
	<ul style="list-style-type: none"> <li>• Net Ground Water Availability for Future Irrigation Development (MCM)</li> </ul>	-79.81		
	<ul style="list-style-type: none"> <li>• Stage of Ground Water Development / Over Draft (%)</li> </ul>	208		
	<ul style="list-style-type: none"> <li>• Category of Block</li> </ul>	OE		
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	Extensive Irrigation		
9.	Percentage of sand thickness up to 50 m depth (Average)	Thickness(m) 7	Percentage % 14	
10	Volume of unsaturated zone	1028		

	available for recharge (MCM)			
11.	Volume of water required for recharge (MCM)		1367	
12.	Volume of surplus water available for recharge(MCM)		11	
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/Water saving in MCM
13	Farm Recharge @Rs. 35000/-	3474	12.16	2.564
14	RWH Rural @ Rs. 25000/-	2934	7.34	1.73
15	RWH Urban@ Rs. 25000/-	1197	3.00	0.047
16	Underground pipe line (area in hectares) @ Rs. 50000/-	4788	23.94	5.66
<b>TOTAL</b>			<b>46.44</b>	<b>10.00</b>

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








**LEGEND**

Decadal Mean Water Level (m.bgl)

-  10.00 to 20.00
-  20.00 to 40.00

Decadal Mean Trend (m)

-  -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

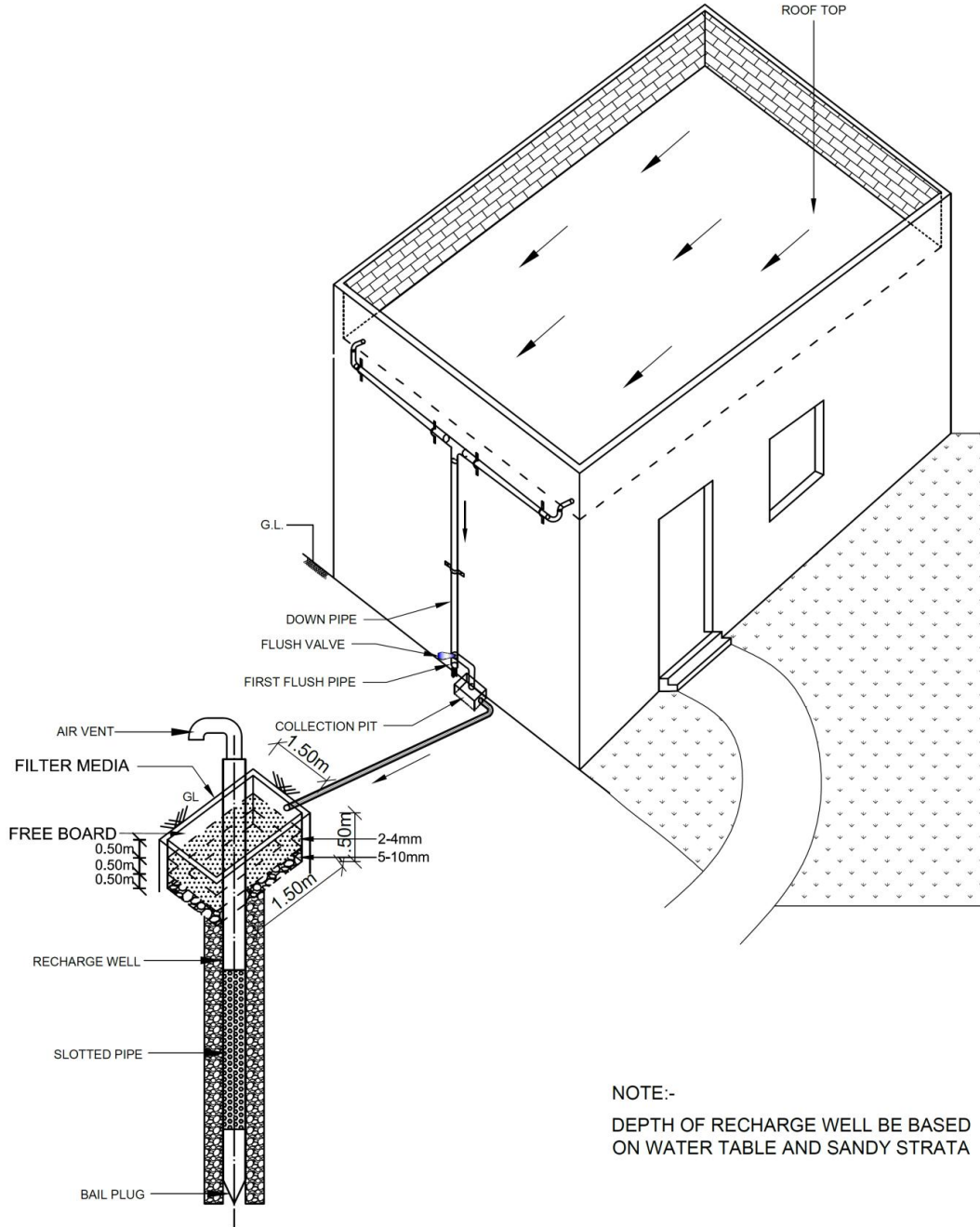
<b>Block Name :- Thaneswar</b> <b>District :-Kurukshetra</b> <b>State :- Haryana</b>		
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	468.27
	<ul style="list-style-type: none"> <li>• Number of Villages inhabited</li> <li>• Un-inhabited</li> </ul>	113 0
	ii) Average Annual Rainfall (mm)	580
2.	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)	404.24
	• Area Sown More than Once (Sq.Km)	--
	• Total Irrigated Area (Sq.Km)	404.01
	• Total Unirrigated Area (Sq.Km)	--
4.	PREDOMINANT GEOLOGICAL FORMATIONS	Younger alluvium
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	
	• Pre- monsoon: (May 2015)	----- (mbgl)
	• Post –monsoon: (Nov2014)	----- (mbgl)
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)	
	• No of wells drilled	19
	• Depth Range (m)	50-463
	• Discharge (lpm)	1374-4140/3 to 6



	Aquifer Parameters			
	• Transmissivity (m <sup>2</sup> /day)	2200/700-525		
	• Storativity	0.12-1*10 <sup>-3</sup> -4.5*10 <sup>-4</sup>		
	• Soil infiltration rate mm/ hour	--		
		<i>Min</i>	<i>Max</i>	<i>Avg.</i>
		--	--	--
7.	GROUND WATER QUALITY	Min	Max	
	• EC in μS/cm at 25 <sup>0</sup> c	--	--	
	• NO3 (mg/l)	--	--	
	• F (mg/l)	--	--	
	• Fe (mg/l)	--	--	
	• As (mg/l)	--	--	
8.	DYANMIC GROUND WATER RESOURCES in MCM	<b>2011</b>		
	• Net Ground Water Availability (MCM)	120.71		
	• Existing Gross Ground Water Draft for Irrigation (MCM)	223.10		
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	23.94		
	• Existing Gross Ground Water Draft for all Uses (MCM)	247.04		
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years MCM	23.94		
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-126.33		
	• Stage of Ground Water Development / Over Draft (%)	205		
	• 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>		
9.	Percentage of sand thickness up to 50 m depth (Average)	<i>Thickness(m)</i> 21.50	Percentage % 43	
10	Volume of unsaturated zone available for recharge (MCM)	1276		
11.	Volume of water required for recharge (MCM)	1697		
12.	Volume of surplus water available for recharge(MCM)	13.65		
RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/Water saving in MCM
13	Farm Recharge @Rs. 35000/-	4641	16.24	3.425
14	RWH Rural @ Rs. 25000/-	4237	10.59	3.19
15	RWH Urban@ Rs. 25000/-	3169	7.92	0.159
16	Underground pipe line (area in hectares) @ Rs. 50000/-	6178	30.89	8.88
<b>TOTAL</b>			<b>65.64</b>	<b>15.65</b>

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



NOTE:-  
DEPTH OF RECHARGE WELL BE BASED  
ON WATER TABLE AND SANDY STRATA

3-D VIEW

### TYPICAL DESIGN FOR RECHARGE PIT IN FARM

