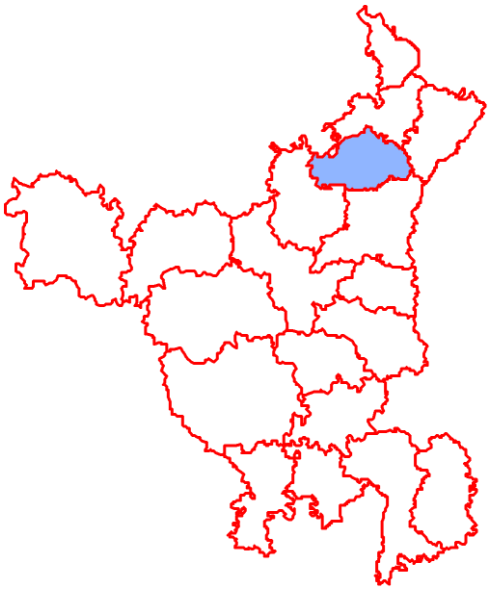
GROUND WATER INFORMATION BOOKLET, KURUKSHETRA DISTRICT HARYANA



CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
2013

Contributors

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Prepared under supervision of

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GROUND WATER INFORMATION BOOKLET
KURUKSHETRA DISTRICT, HARYANA

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KURUKSHETRA DISTRICT AT A GLANCE

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	ii) Administrative Divisions (as on 17.01.2013) Number of Tehsil / Block	 03/06
	iii) Population (as on 2011 Census)	964231
	iv) Normal Annual Rainfall (mm)	582
2.	GEOMORPHOLOGY	
	Major Physiographic units	Alluvial Plain
	Major Drainages	Markanda River
3.	LANDUSE (Sq.Km)	
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	b)Net area shown	1510
	c) cultivable area	1520
4.	MAJOR SOIL TYPES	Clayey loam, Sandy loam
5.	AREA UNDER PRINCIPAL CROPS (sq.km)	Wheat: 1142 Rice: 1198 Sugarcane: 85 Bajra: 0.5 Oilseeds:42
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Numbers of Structures)	
	Dugwells	Nil
	Tube Wells/Boreholes	1230 sq.km, 56599 Nos.
	Tanks/Ponds	Nil
	Canals	280 sq.km,
	Other Sources	Nil
	Net Irrigated area	1510 sq.km
	Gross irrigated area	2710 sq.km
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB No. of Dug Wells No. of Piezometers	 NIL 10
8	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary Alluvium
9	HYDROGEOLOGY	

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10	GROUND WATER EXPLORATION BY CGWB	
	No of wells drilled (EW, PZ, SH)	05,35,0
	Depth Range (m)	EW:104-450, Pz:50-445
	Discharge (litres per minute)	1374-4140
	Storativity (S)	$1.3x10^{-3}$ to $6.6x10^{-4}$
	Transmissivity (m^2/day)	830m^2/day-2424m^2/day
	No of PZs constructed through outsourcing by M/s WAPCOS Ltd.	09
.11	GROUND WATER QUALITY	
	Presence of chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	EC: NIL F: 2.76 mg/l As: NIL Fe: 2.86 mg/l Zn: 15.38 mg/l
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12	DYNAMIC GROUND WATER RESOURCES (As on 31st March 2009)	
	Annual Replenishable Ground Water Resources	343.23 MCM
	Net Annual Ground water Draft	746.41 MCM
	Net Ground Water Availability for future irrigation development	(-) 403.18 MCM
	Stage of ground Water Development	217%
13	AWARENESS AND TRAINING ACTIVITY	01
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15	GROUND WATER CONTROL AND REGULATION	
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	Number of Critical Blocks	Nil
	No. of Blocks notified	03
16	MAJOR GROUND WATER PROBLEMS AND ISSUES.	Depletion of Ground Water Resources, Fluoride concentration and contamination with Iron

GROUND WATER INFORMATION BOOKLET
KURUKSHETRA DISTRICT, HARYANA

1.0 INTRODUCTION

Kurukshetra district, falls in the north-east part of the Haryana State and is bounded by North latitudes $29^{o}53'00"$ and $30^{o}15'02"$ and East longitudes $76^{o}26'27"$ and $77^{o}07'57"$. It falls in parts of Survey of India Topo-sheets nos. 53B and 53C covering an area of 1530 sq.km. The district covers 3.46% area of the State. The district is bordered by districts of Haryana State namely Karnal district in the south and south eastern, Kaithal district in the south western and Ambala district in the north. The district is also bordered by Patiala district of Punjab State in the north-west.

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. The population density is 630 persons per sq.km against the state average of 573persons per sq.km.

The eastern parts of the district falls in the Upper Yamuna Basin and western parts falls in Ghaggar basin. The river Markanda provides the major drainage in the area. Irrigation in the district is done by surface water as well as ground water. Depletion in ground water resources are the major concern of the district.

2.0 RAINFALL & CLIMATE

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.

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KURUKSHETRA DISTRICT,HARYANA

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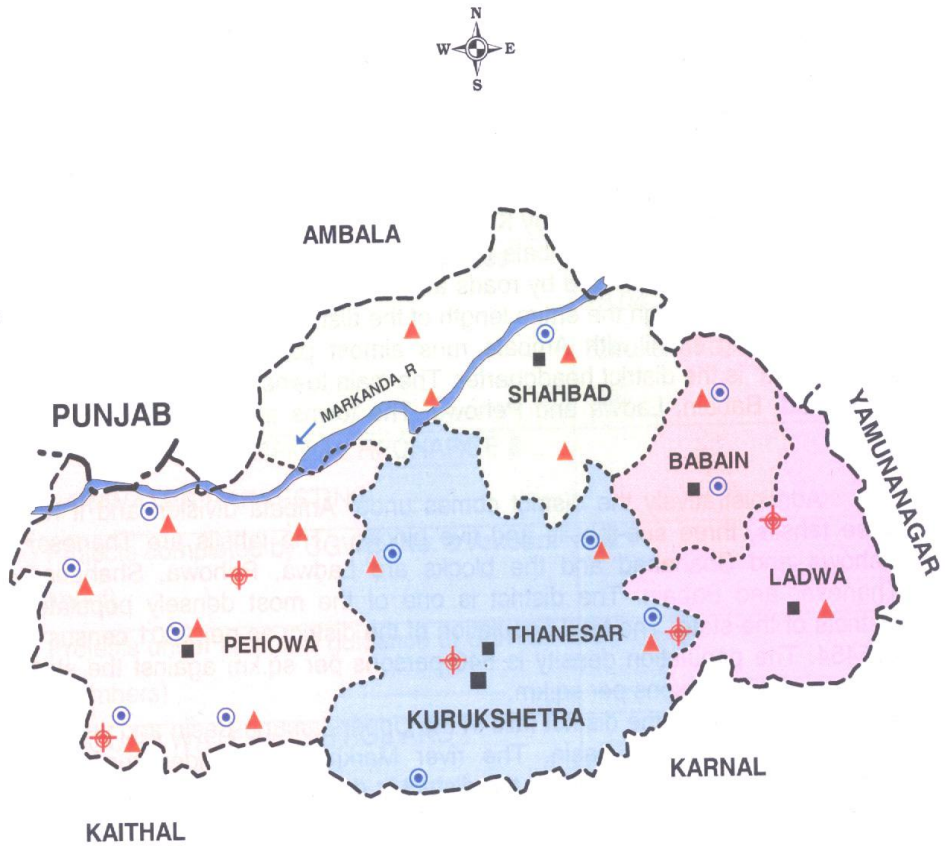
kilometres



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- EXPLORATORY WELL
- PIEZOMETER
- DISTRICT HEAD QUARTER
- BLOCK HEAD QUARTER
- STATE BOUNDARY
- DISTRICT BOUNDARY
- BLOCK BOUNDARY

3.0 GEOMORPHOLOGY & SOIL TYPES

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 nalas 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.

4.0 IRRIGATION AND AGRICULTURE

Irrigation: Out of 1,51,000 ha net irrigated area, 28000 ha is irrigated by canal and 1,23,000 ha is irrigated by ground water. About 81% of the irrigation is based on ground water resources, which indicates the heavy stress on the ground water resources for irrigation sectors. The gross irrigated area has been worked out as 271000 ha, which is 4.9% to the State total. Percentage of Gross Area Irrigated to Total Cropped Area has been worked out as 100% with the irrigation intensity of 179.5.

Agriculture: Net area sown in the district is 1,51,000 ha which constitutes about 90 % of the total area. Area sown more than once is 1,20,000 ha bringing the total cropped area (Gross sown area) to 2,71,000 ha. Paddy constitutes main kharif crop whereas the wheat is the main Rabi crop. The details of area under cultivation, production and average yield of important crops of the district during the year 2011-12 is given in table below:

.Crops	Area under cultivation (ha)	Production (Tonnes)	Average yield (Kgs/ha)
Rice	1,19,800	3,83,000	3,195
Wheat	1,14,200	5,10,000	4,472
Sugarcane	8,500	63,000	6,993

5.0 GROUND WATER CONDITIONS

5.1 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^2/day. The storage coefficient values ranges from $1.38x10^{-3}$ to $6.6x10^{-4}$. 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^2/day)	'K' (Lateral)	Storativity
I	Unconfined	2,200	24	0.12
II	Semi-confined	700	7.2	$1x10^{-3}$
III	Confined	525	7.1	$4.5x10^{-4}$

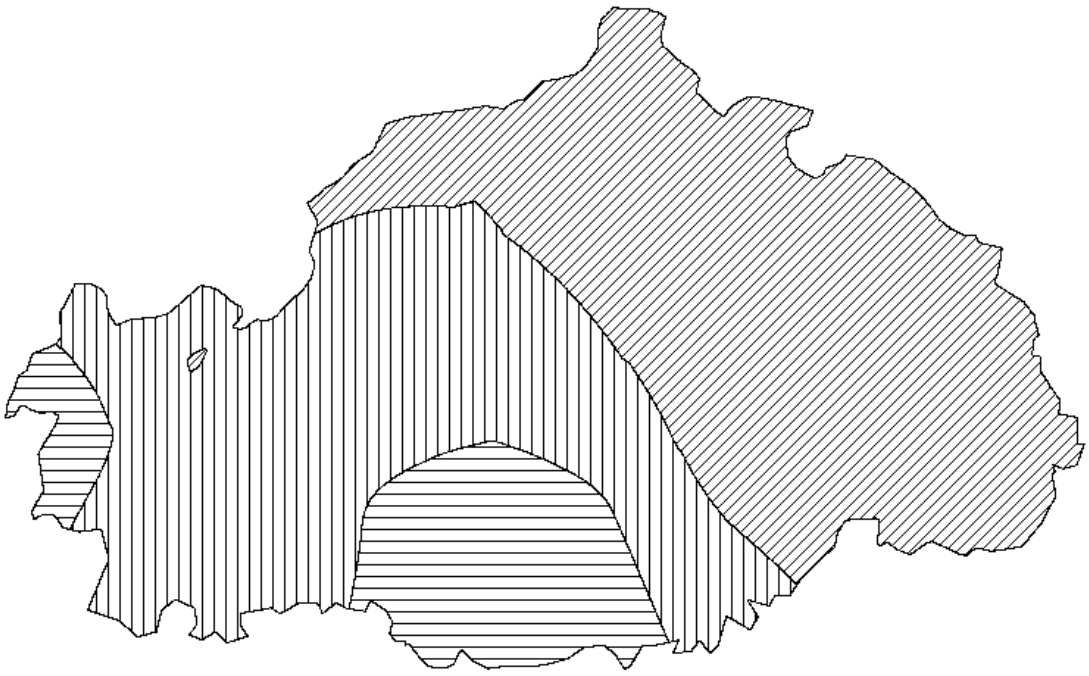
5.2 WATER LEVEL BEHAVIOR

Depth to water level in the district ranges from 20.18 m to 32.64 m bgl during pre monsoon period 21.80m to 34.41 m bgl during post monsoon period 2011. 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.

Long-term net change of water levels during the period 2000-2011 indicates a general decline (negative change) in the entire district and it range between 1.14 m/yr to 1.71 m/yr. The maximum rate of decline has been observed in piezometer at Shahabad. It is pertinent to mention that the rate of decline in general has been worked out to be more than 1.0 m/yr. Elevation of the water table in the district varies from 205 m to 240 m above mean sea level. Average gradient of the water table is of the order of 1.08 m/km. Overall flow of ground water is towards south- west direction.

KURUKSHETRA DISTRICT, HARYANA

DEPTH TO WATER LEVEL (PREMONSOON 2011)



LEGEND

Depth To Water Level (m. bgl)

20.18 - 25

25 - 30

More Than 30 (32.66)

KURUKSHETRA DISTRICT, HARYANA
DEPTH TO WATER LEVEL
(POSTMONSOON, 2011)

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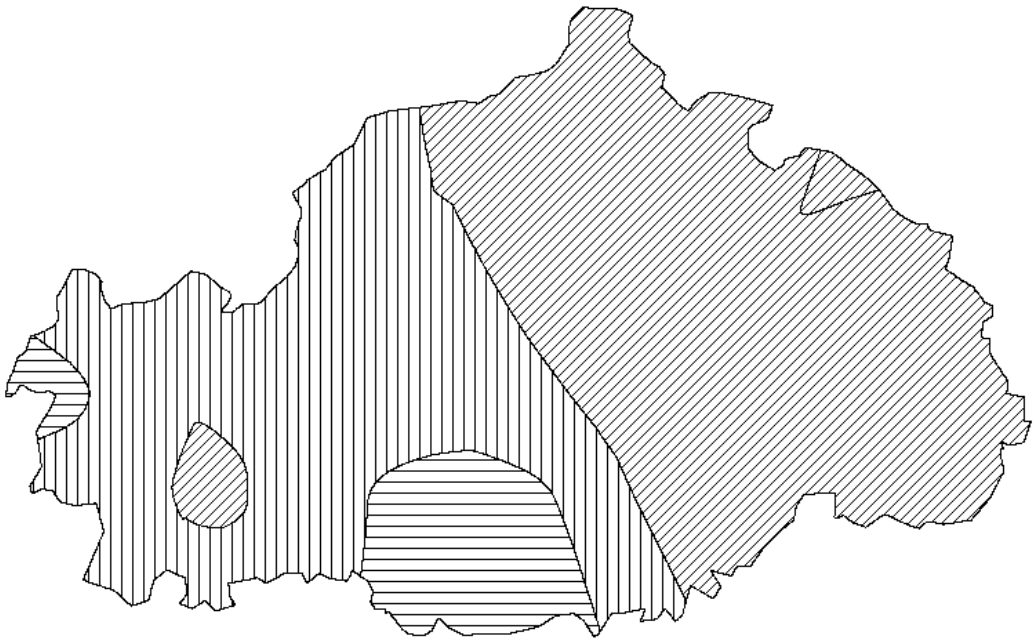

LEGEND

Depth to Water Level (m bgl)

- 21.80 - 25
- 25 - 30
- More Than 30 m (34.41)

5.3 GROUND WATER RESOURCES

Block-wise ground water resource potential of the district has been assessed as per GEC-97 as on 31st March 2009. 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 -187% (block-Pehowa) to 331% (block-Ladwa). Net annual replenishable ground water availability in the district have been assessed as 343.23 MCM. The total ground water draft for all uses in the district is 746.41 MCM, thus leaving shot-fall (over draft) of 40318 MCM. Stage of ground water development in the Kurukshetra district has been assessed to be 217%.

The block-wise ground water resource potential as on 31st March 2009 in the district are as follows:-

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	2496	6127	723	6850	723	-4354	274	**Over Exploited**
Ladwa	3227	9542	1126	10668	1126	-7441	331	**Over Exploited**
Pehowa	10077	17494	1337	18831	1337	-8754	187	**Over Exploited**
Shahabad	7732	13517	1157	14674	1157	-6942	190	**Over Exploited**
Thaneswar	10791	21224	2394	23618	2394	-12827	219	**Over Exploited**
Total	**34323**	**67904**	**6737**	**74641**	**6737**	**-40318**	**217**	

GROUND WATER DEVELOPMENT POTENTIALS AND CATEGORISATION OF BLOCKS

KURUKSHETRA DISTRICT,HARYANA

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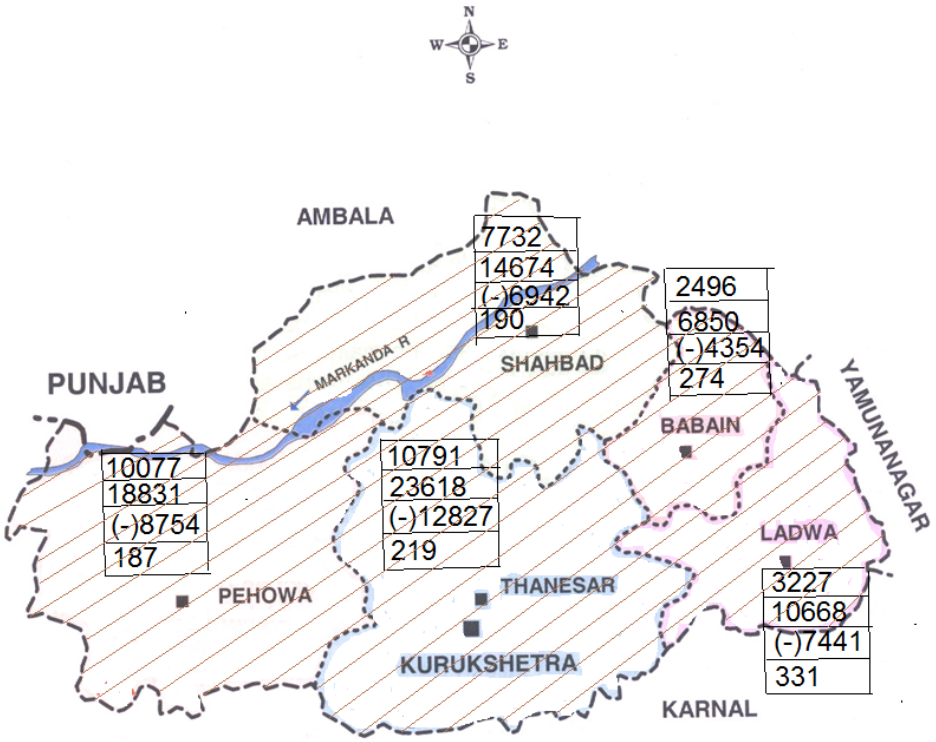

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10791	Net Annual Ground Water Availability (ham)
18831	Existing Ground Water Draft for all uses (ham)
(-)12827	Net Ground Water Availability For Future Irrigation development (ham)
331	Stage of Ground Water Development (%)
	Over-exploited Block

5.4 Ground Water Quality (Irrigation and Drinking point of view)

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^{o}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_2S_1 and C_3S_1 classes and are therefore suitable for customary irrigation on well drained soils.

Type of water: Na-HCO_3 type and Mixed cation-HCO_3 type.

5.5 STATUS OF GROUND WATER DEVELOPMENT

Irrigation in the district is based on both ground water and canal water. Ground water contributes about 81 % of the total need for agriculture. Ground water is being extracted through no. of shallow tubewells and dug cum bore wells. The tubewells are generally of filter type and tap the aquifer up to the average depth of 60-80m. There are about 37,516 Nos. of minor irrigation tubewells exist in the district and used for irrigation to the agriculture purposes. The block-wise detail of MIUs and draft is given below:

Sl.No	Block	Shallow T/W with	Ground Water Draft (Ham)		
			Monsoon	Non-Monsoon	Annual
1	Babain	3385	2757	3370	6127
2	Ladwa	5272	2863	6680	9542
3	Pehowa	9665	7872	9622	17494
4	Shahabad	7468	6083	7434	13517
5	Thanesar	11726	9551	11673	21224

The entire drinking water supply to all rural as well as urban parts of the district is based on ground water only due to the fresh and potable quality of ground water. The tubewells constructed by Public Health Department, Haryana for drinking water supply are generally between 80 to 150m deep. The block-wise detail of numbers of tubewells and draft is given below:

Sl.No	Block	No. of Tubewells	Ground Water Draft (ham)
1	Babain	50	724
2	Ladwa	90	1126
3	Pehowa	105	1338
4	Shahabad	129	1157
5	Thanesar	237	2394

6.0 GROUND WATER MANAGEMENT STRATEGY

6.1 Ground Water Development

The stage of ground water development for the district is 217% and all the five blocks for which the assessment made is fall in over-exploited categories, indicates the ground water is under stress and the ground water level is declining. There is need to take up the measures to reduce the dependence on ground water adopting practices of water conservation techniques and to enhance the ground water resources by implementing the projects of rain water harvesting and artificial recharge to ground water. Whole of the district is suitable for artificial recharge to ground water. Excess rain water in agricultural field, surplus canal water and rooftop rain water can be injected to ground water system. Recharging shafts and injection wells are recharging structures suitable for the district. As the multiple aquifer system exists in the district and having fresh and potable water, however, ground water development of deeper aquifers may be encouraged.

6.2 Water Conservation & Artificial Recharge

There are 163 tanks /ponds in the Kurukshetra district which act both as water conservation and recharge structures. There is need to revive the tradition water bodies of the villages. The block-wise details on tanks/ponds and recharge through them is given in table below:

Name of Block	**No of Tank/ Pond**	**Average water sprea area(ha)**		**No of days water is available**		**Recharge in Ha.m. during**	
		monsoon	**non-monsoon**	**monsoon**	**non-monsoon**	**monsoon**	**non-monsoon**
Ladwa	31	44.95	21	120	200	7.76736	6.048
Babain	14	44.95	21	120	200	7.76736	6.048
Shahbad	15	22.2	11	120	200	3.83616	3.168
Thaneshwer	49	69.6	30	120	200	12.02688	8.64
Pehowa	54	78	38	120	200	13.4784	10.944

Under Central Sector scheme of Ministry of Water Resources, Central Ground Water Board in collaboration with State Government Department, has executed three schemes on artificial recharge to ground water in the district. The salient features of the schemes are as follows:

(i) On the Markhanda river bed at Shahabad; two lateral trenches of 50 m long with 05 injection wells were constructed to inject river flow. The depth of injection wells had kept around 30m.

(ii) Near Brahma Sarover, Kurukshetra; 02 Nos of recharge shafts and 02 Nos of injection wells were constructed to inject the pumped out water of the Brahm Sarover.

(iii) In the villages Kirmich and Samaspur; 06 Nos of recharge shafts in each village were constructed to inject the water collected in depressions. The average depth of shafts were kept around 12m.bgl.

7.0 GROUND WATER RELATED ISSUES & PROBLEMS

The main issue of concern related to ground water is the depleting ground water resources, which is being reflected through the declining ground water level. The analysis of long term water levels in the district shows the rate of decline of water level is in the range of 1.14 m/yr to 1.71 m/yr. Besides, contamination of water with fluoride and some heavy metals is also needs to be addressed at various forum.

8.0 AWARENESS & TRAINING ACTIVITY

Central Ground Water Board has organized Mass Awareness Programme in the district during the year 1998-1999 and 2000-01. During the programme it was focussed that there is need to conserve water resources by adopting various water conservation practices and irrigation efficiency techniques. The cropping pattern of the district is also needs to be checked for reducing stress on ground water for agriculture sector. Besides, an exhibition was also set up displaying maps, figures, data and posters on ground water conservations.

9.0 AREAS NOTIFIED BY CGWA

The Central Ground Water Authority (CGWA) has notified Shahabad Block on 02.12.2006 and Pehowa & Ladwa Blocks on 13th August, 2011. The block area has been notified with a view to protect the ground water resources and other development activities in consonance with protection & preservation of ground water resources. .

10.0 RECOMMENDATIONS

1. The directives of CGWA notification for the notified blocks namely Shahabad, Pehowa and Ladwa should be implemented.
2. Strict regulatory measures are required for ground water pumpage for agriculture sector, as it accounts for more than 90 % of total ground water draft for all usage in the district.
3. Rain water harvesting and its recharge to the ground water should be made mandatory for all the Government buildings in rural and urban areas.
4. Ground water pumping from deeper aquifers may be encouraged so that stress on dynamic resources could be minimized.
5. The change in cropping pattern at least on experimental basis or in a certain part of the land holdings may be encouraged so that stress on ground water could be minimized.
6. Revival of water bodies like pond in the village could be recommended under scheme of drinking water mission for the sustainability of shallow tube wells and the crop of the area.
7. Micro level study may be carried out for development of flood plain aquifers of river Markanda.
8. Micro level mapping of the ground water for fluoride concentration and heavy metal contamination may be taken up and people may be educated about its harmful effect on human health and its remedial measures.