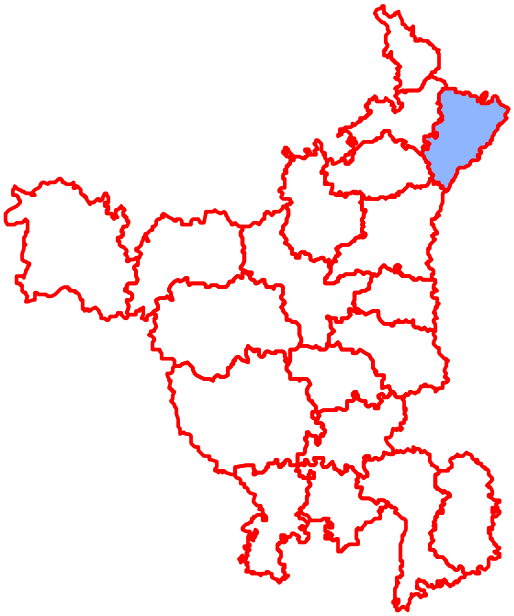
Ground Water Information Booklet

YAMUNANAGAR DISTRICT HARYANA



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

2012

Contributors

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Prepared under supervision of

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GROUND WATER INFORMATION BOOKLET
YAMUNA NAGAR DISTRICT, HARYANA

C O N T E N T S

YAMUNA NAGAR DISTRICT AT A GLANCE

Sl.NO.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	Geographical Area (sq. km.)	1756
	Administrative Divisions	
	Number Of Tehsils (2)	1. Jagadhri 2. Chhachhrauli
	Number Of Blocks (6)	1. Bilaspur 2. Chhachhrauli 3. Jagadhri 4. Radour 5. Sadhoura 6. Mustafabad
	Number Of Panchayats	-
	Number Of Villages	623
	Population (As per 2011Census)	12,14,205
	Average Annual Rainfall (mm)	1107
2.	GEOMORPHOLOGY	
	Major Physiographic Units	Alluvial Plains
	Major Drainage	Yamuna R. Markanda R.
3.	LAND USE (Sq.Km.)	
	a. Forest Area:	150
	b. Net area sown:	1250
	c. Cultivable area:	1260
4.	MAJOR SOIL TYPES	Sandy loams to loamy sands
5.	AREA UNDER PRINCIPAL CROPS (Sq. Km.)	1763
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number Of Structures) Sq.Km	
	Dug wells	-

	Tubewells/Bore wells	1090 sq.km. 28,561/200
	Tanks/ponds	-
	Canals	40 sq.km.
	Other sources	-
	Net Irrigated area	1130 sq.km.
	Gross irrigated area	1860 sq. km.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB	
	No. of dug wells	9
	No of Piezometers	9
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium
9.	HYDROGEOLOGY	
	*Major Water bearing formation *Pre-monsoon depth to water level *Post-monsoon depth to water level *Long term water level trend in 10 yrs in m /yr	Alluvium (Sand & Gravel) 2.17 – 16.02 2.04 – 15.30 m 0.00013 to 0.0389 (Fall)
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW OW PZ SH	 13 04 15 -
	Depth range (m)	55-460m
	Discharge (liters per minute)	2700-4800 lpm
	Storativity (S)	$2.1 X10^{-2}$
	Transmissivity (m^2/day)	1890-3469
11.	GROUND WATER QUALITY	

	Presence of Chemical constituents more than the permissible limit EC, in micromhos at 25^0C F, in mg/l As, in mg/l Fe, in mg/l	 - - 0.0152 mg/l Rasulpur, 8.47 mg/l Sabri, 2.74 mg/
	Type of water	Mixed cation-HCO_3 type
12	DYNAMIC GROUND WATER RESOURCES (2009) MCM	
	Annual Replenish able Ground water Resources	481.99
	Net Annual Ground water Draft	652.92
	Projected Demand for Domestic and industrial Uses upto 2025	104.71
	Stage of Groundwater Development	135%
13	AWARENESS AND TRAINING ACTIVITY	-
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	-
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks.	5
	No. Critical Blocks	1
	No. of blocks notified	-
16	MAJOR GROUND WATER PROBLEMS AND ISSUES.	Declining of water levels Rising of Water levels

HYDROGEOLOGICAL INFORMATION BOOKLET OF YAMUNA NAGAR DISTRICT

1.0 INTRODUCTION

Yamuna Nagar district of Haryana located in north-eastern part of Haryana State and lies between 29^o 55': 30^o 31' north latitudes and 77^o 00': 77^o 35' east longitudes. The district is bounded, in north by Himachal Pradesh, in the east by Uttar Pradesh, in west by Ambala district, in south by Karnal and Kurukshetra districts. Total geographical area of the district is 1756 sq.km and comprises 4% of total area of State.

Yamuna Nagar district is divided into one sub-division and six-development blocks viz. Bilaspur, Chachrauli, Jagadhri, Mustafa bad, Radaur and Sadhaura. Yamuna Nagar is thickly populated district. The population of the district is 12,14,205 as per 2011 census.

The district is mainly drained by the rivers Yamuna, Markanda and its tributaries. Markanda is tributary of river Ghaggar and drains major part of the district. The high land between Markanda River and small rivulets of River Yamuna acts as basin boundary between west flowing rivers of Indus system and east flowing rivers of Ganga basin. River Yamuna drains eastern part of the district and acts as boundary between Haryana and Uttar Pradesh State.

Yamuna Nagar district is bestowed with rich water resources, both surface as well as ground water resources. The ground water is major sources of irrigation in the district. Nearly 40% of area is irrigated by canal water. Distributaries in the district are 21.45 Km long. Two major canals passing through the district are Western Yamuna Canal and augmentation canal. Length of unlined WJC is 63.64km whereas augmentation canal is 22.54 km long. Net irrigated area is 1130Km^2 whereas, gross irrigated area 1860Km^2. Percentage of gross area irrigated to total cropped area is 91.6%.

Systematic hydro geological surveys in the district was carried out by Geological Survey of India during 1956-61.Re-Appraisal Hydro Geological Surveys in the district were carried out by Central Ground Water Board, during 1975-77,1981-82 and 1988-89.detailed hydro geological and water balance studies were carried out under Ghaggar and Upper Yamuna Projects. Ground water exploration has been carried out in various phases and so far 13 exploratory wells, 4 slim holes and 15 piezometers have been constructed in the district.

2.0 CLIMATE & RAINFALL

The climate of Yamuna Nagar district can be classified as subtropical monsoon, mild &dry winter, hot summer and sub-humid which is mainly dry with hot summer and cold winter except during monsoon season when moist air of oceanic

origin penetrates into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the southwest monsoon which lasts up to September. The transition period from September to

November forms the post monsoon season. The winter season starts late in November and remains up to first week of March.

The normal annual rainfall of the district is 1107 mm, which is unevenly distributed over the area in 43 days. 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 thunderstorms.

Rainfall	
Normal Annual Rainfall	1107 mm
Normal monsoon Rainfall	898 mm
Temperature	
Mean Maximum	48.8°C (May &June)
Mean Minimum	6.8 °C (January)
Normal Rainy days	43

3.0 GEOMORPHOLOGY AND SOILTYPES

3.1 Physiography

The district is divided into four Physiographic units

- Siwaliks
- Dissected Rolling Plains
- Interfluvial Plains
- Active And Recent Flood Plains
- Relict Plains

Siwaliks hills - Siwalik hill ranges occupy the northern fringe of Yamuna Nagar district and attain the height up to 950m AMSL. The hills are about 500m high with respect to the adjacent alluvial plains. These are characterized by the broad tableland topography that has been carved into quite sharp slopes by numerous ephemeral streams come down to the outer slopes of the Siwaliks and spread much of gravels boulders, pebbles in the beds of these streams.

Kandi Belt - A dissected rolling plain in the northern parts of district is a transitional tract between Siwaliks hills and alluvial plains. It is about 25 km wide and elevation varies between 250 and 375m AMSL.

Interfluvial plains - This tract is part of higher ground between Ghaggar and Chautang and includes high mounds and valleys. In general, the slope is from northeast to southwest.

Active and recent flood plains - This plain is narrow tract along river Yamuna in the district.

Relict wedge plain - This is almost in alignment to the surface water divide between the westward flowing Ghaggar and eastward flowing Yamuna River.

3.2 Soil Types

- **Eurtrochrepts/ Udorthents -** These are shallow and loamy sands to fine sandy loams, except in depressions, well-drained, non-saline, non-alkali, non-calcareous, mostly base saturated and are classified as loamy skeletal typic, lithyhic, eurtrochrepts/ udorthents. These soils are found in the Siwalik range.

- **Udipsamments/ udorthents -** These are loamy sand to sandy loam deep, excessively or well-drained, non-saline, non-alkali. These are placed under the associations of transitional tract between Siwaiks hills and alluvial plains.

- **Psammaquents and Haplaquepts -** These soils are found in Yamuna Plains

- **Haplaquept -** These soils are non saline, alkalinity hazards are classified as typic ustochrepts but water logged soils with loam to clay loam texture showing the effect of glazing, are classified as aeric/ typic Haplaquepts. Areas as aeridic soil moisture, moisture have soils classified as camborthics and torropsamments.

4.0 GROUND WATER SCENARIO

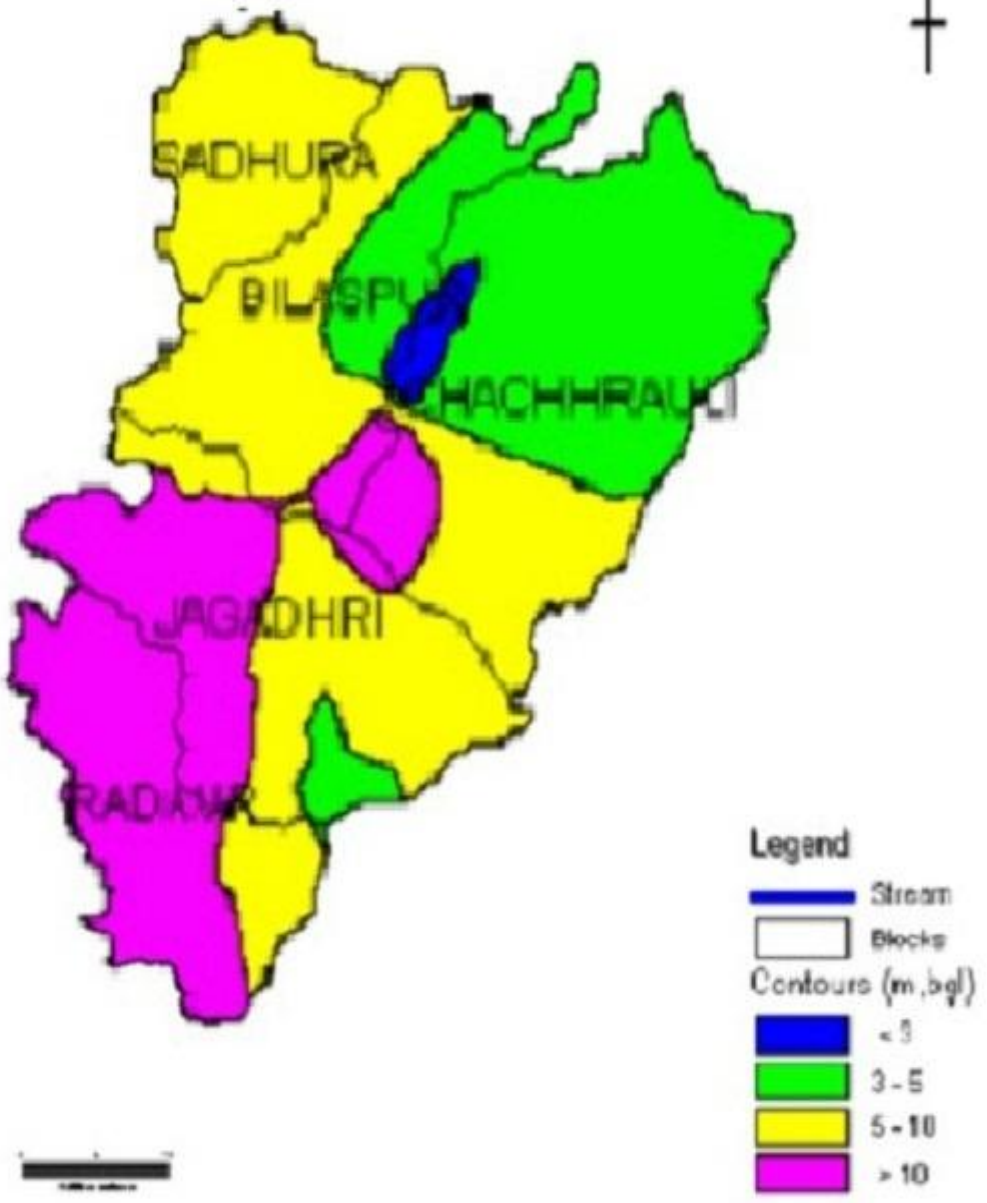
4.1 Hydrogeology

The ground water exploration in the district reveals that clay group of formations dominates over the sand group in the district area. Ground water in the district occurs in the alluvium under water table and semi-confined to confined conditions. These aquifers consist of sand, silt, gravels and kankar associated with clay and form highly potential aquifers. In alluvium, the permeable granular zones comprise fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and as well as vertical extent is extensive. In Kandi belt, which has not been explored fully boulders cobbles and pebbles, constitutes the major aquifer horizon. Siwalik Hills occupy marginal areas in the northeastern parts of the district constitute a low potential zone.

In Kandi areas, the shallow aquifers are isolated lenses embedded in clay beds whereas aquifers in alluvial areas occur on regional scale and have pinching and swelling disposition and are quite extensive in nature. These aquifers generally consists sands (fine to coarse grained) and gravels and are often intercepted by clay and kankar horizons. These aquifers are under unconfined to semi-confined conditions and support a large number of shallow tubewells within the depth of 50m only. The discharge of these tubewells varies between 100lpm and 500 lpm for moderate tubewells.

DEPTH TO WATER LEVEL- PRE-MONSOON 2012

DEPTH TO WATER LEVEL MAP
(POST-MONSOON, 2012)



Under ground water exploration programme thirteen exploratory wells were drilled in the district. On average 3-12 of granular zones were deciphered in the depth range down to 450 m bgl. Exploratory wells drilled in depth range of 130 and 180 m bgl yield discharge in the range of 2700 to 4900 lpm for drawdown of 6.0 m to 12.0 m and Transmissivity of aquifers range between 1500 to 4900 m^2/day. The yield potentials of aquifer below 200.0m bgl are yet to be evaluated.

Depth to water level

The depth to water level during pre-monsoon period in the district ranges between 2.17m bgl at Choli and 16.02m bgl at Khizrabad. However, in major part of district water level ranges between 5.0m bgl and 10.0m bgl covering the Central and Northern portion of the district, while southern and North-eastern portion covering Radaur and Chacharauli blocks show water level more than 10 m ranging upto 16.02 m bgl. The Depth to water level during post-monsoon period in the district ranges between 2.04m bgl at Choli and 15.30m bgl at Dharaung. However, in major part of district water level ranges between 5.0m bgl and 15.0m bgl. The long term water level fluctuation shows a declining trend ranging from 0.17 m to 3.06 m. Maximum decline is shown in Rasulpur village of Sadhaura block. There is rise also seen in the Northern portion of the district ranging from 0.25 m to 4.94 m.

The discharge of the shallow tubewells tapping unconfined aquifers e tubewells ranges from 100 lpm to 500 lpm with moderate Drawdown values. Near Manakpur, a phreatic aquifer extending down to 88.0m bgl has Transmissivity value of 2500m^2/day, lateral hydraulic conductivity of 31m /day, and specific yield of $2.1*10^{-2}$

4.2 Ground Water Resources

The block wise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 97% (block-Bilaspur) to 181% (block-Jagadhri). The total replenish able ground water resource in the district is 481.99 mcm, of which the total existing ground water draft by all means is 652.92 mcm. The net utilizable ground water resources for future irrigation development are -173.49 MCM.

GROUND WATER RESOURCES OF YAMUNA NAGAR DISTRICT, HARYANA as on 31.03.09

Block Name	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation domestic industrial upto next 25 years (Ham)	Net Ground Water Availability for future irrigation development (Ham)	Stage Ground Water Development (%)	Category of Block
Bilaspur	8924	7003	8668	1921	0	97	Critical
Chhachhrauli	12409	11988	13803	1815	-1394	111	Over-Exploited
Jagadhri	7325	10011	13236	3225	-5911	181	Over - Exploited
Mustafabad	6812	9372	10602	1230	-3790	156	Over - Exploited
Radaur	7922	11825	13175	1350	-5253	166	Over - Exploited
Sadhaura	4807	4878	5808	930	-1001	121	Over - Exploited
TOTAL	**48199**	**55077**	**65292**	**10471**	**-17349**	**135**	

4.3 Ground Water Quality

The ground water of the district is alkaline in nature and is of low to medium salinity. Specific conductivity is a measure of total dissolved solids present in water and it ranges from 357µS/cm to 751µS/cm at 25^0C. However, saline ground water-having EC value of 2180µS/cm is found at Mustafabad. Among anions, bicarbonate is the dominant anion and among cations**,** none of the cation dominates.

Suitability of Water

Domestic

Ground water occurring in the shallow aquifer is by and large, fresh and potable. All chemical parameters are within the permissible limits for safe drinking waters set by BIS except nitrate at Bilaspur and Mustafabad where its values are 60 mg/l and 89 mg/l respectively, iron at Sabri (2.74mg/l) and Rasulpur (8.47mg/l) and arsenic at Shadipur (0.0152 mg/l).

Irrigation

Plot of USSL diagram used for the classification of irrigation waters indicated that ground water fall under classes C_2S_1 and C_3S_1 and are therefore suitable for customary irrigation without any fear of sodium hazards on well drained soil.

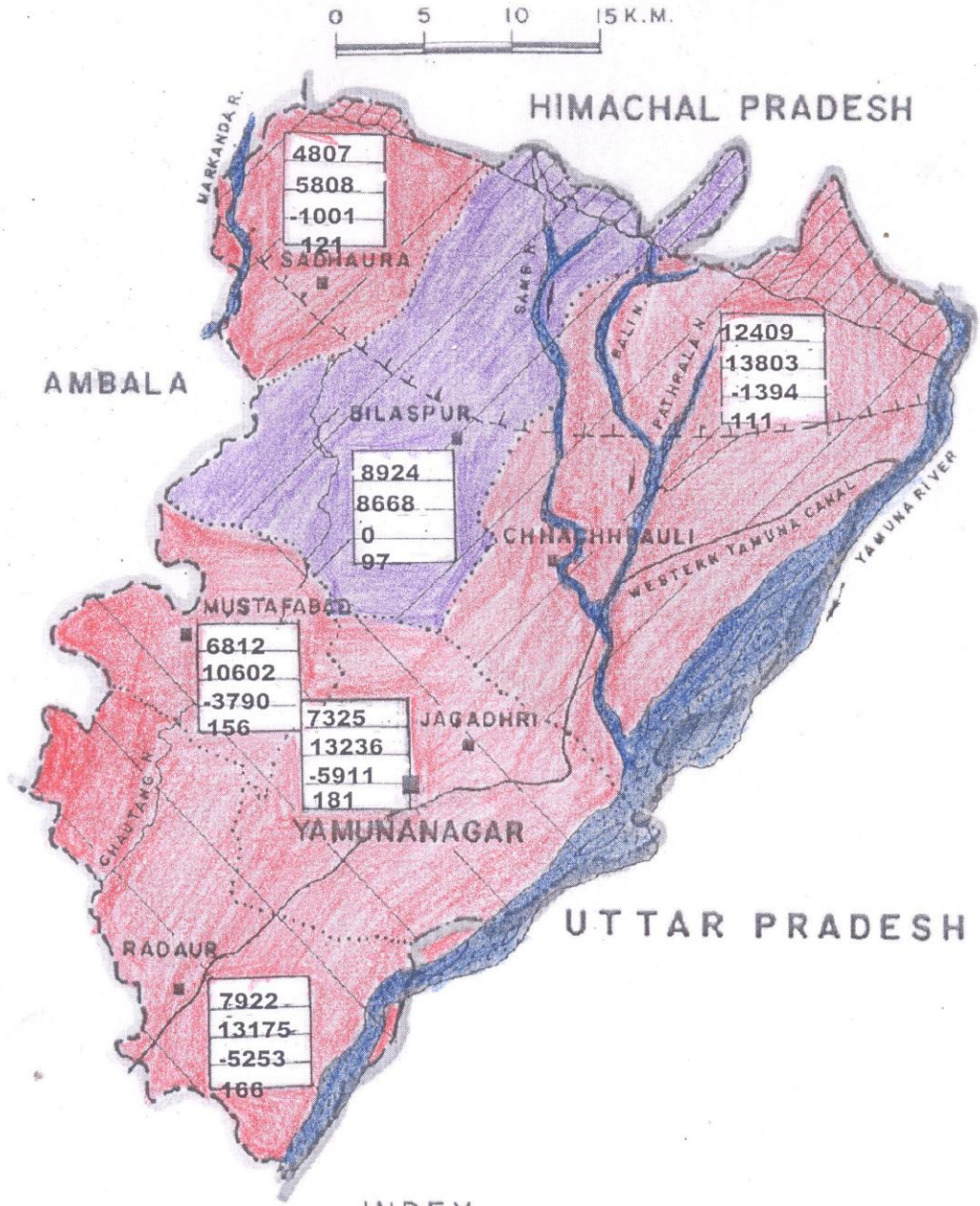
Presence of chemical constituents more than the permissible limits

Constituent	No. of wells	Location with conc.
EC > 3000µS/cm (n=14)	nil	--
Fluoride >1.5mg/l (n=14)	nil	--
Arsenic > 0.01mg/l (n=9)	1	Shadipur, 0.0152mg/l
Iron >1.0mg/l (n=6)	2	1. Rasulpur, 8.47 mg/l 2. Sabri, 2.74 mg/l

Type of water: Mixed cation-HCO_3 type

GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS

YAMUNANAGAR DISTRICT, HARYANA



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48199	TOTAL REPLENISHABLE RESOURCES MCM
65292	GROSS DRAFT MCM
-17349	FUTURE GROUND WATER AVAILABILITY MCM
135	STAGE OF GROUND WATER DEVELOPMENT %

CRITICAL

OVER EXPLOITED BLOCK

CGWB NWR CH. (N.Singh) D.O. NO. 205/07

4.4 Status of Ground Water Development

Gross area irrigated in the district is 1860 Km^2, whereas net area irrigated is 1130 Km^2 , percentage of gross area irrigated to total cropped area is 91.6%. Nearly about 1040 $Km^{2\ of}$ area is irrigated through 28561 shallow tube wells and pump sets, besides this there are 200 deep public tube wells. The discharge of shallow tubewells varies between 200 lpm and 480 lpm, whereas the discharge of deep tubewells varies between 2000 lpm and 3500 lpm. The depth of shallow tubewells ranges between 40-80m, whereas deep tubewells range up to 270m depth. Of the shallow tube wells 8851 are diesel engine operated and remaining 19710 are run by electric motors. The drinking water supply is mainly ground water based in the district, besides piped water supply, the public health department as well as public has installed hand pump as most convenient water source to meet water shortage in villages and towns.

The Yamuna is Perennial River and descending from Himalayas in Uttarakhand and a dam has been constructed at Tajewala to harness water, which is being used for irrigation in west Yamuna canal areas. But this water is used mostly in other districts. In Yamuna Nagar district, only 40 Km^2 area is irrigated by this canal system.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The hydrogeological data generated through exploratory drilling has proved a vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, delineation of potential aquifer characteristics. These studies also provide information on well design and drilling techniques. A well assembly of 203mm dia, using about 20m to 30m long housing pipe and MS slot pipe with slots of 1.19 mm to 1.59 mm size would be ideal in the district area. “V” wires galvanized Screen having 0.50- 1.5mm slot can also be used as it can provide more open area conventional slotted pipes. Entrance velocity of water in the well has to be kept in mind while designing the well assembly.

Reverse/ Direct circulation rig is suitable for carrying out the drilling in alluvial parts of district whereas percussion or Down The Hole Hammer (DTH) technique with Odex attachment are suitable for drilling in bouldary formation.

5.2 Water Conservation and Artificial Recharge

There are about 553 tank/pond in the district. Their block wise distribution and recharging contribution is shown in the following table

Block	No. of Tank/ Pond	Average water spread area(ha)		No of days water is available		Recharge in Ha.m. during	
		Monsoon	Non-Monsoon	Monsoon	Non-Monsoon	Monsoon	non-Monsoon
Bilaspur	187	50	25	90	35	6.48	1.08
Chachrauli	94	26	9	90	30	3.3696	0.388
Jagadhri	123	30	20	90	30	3.888	0864
Mustafa bad	60	30	20	90	30	3.888	0.864
Radaur	25	25	5	90	30	3.24	0.216
Sadhaura	64	12	8	90	30	1.5552	0.3456
Total	553	173	87	540	185	22.4208	3.7576

Besides the above, there are two dams, which contribute towards the ground water recharge in the district

Block	No. of dams	Storage capacity (Ha. m)	No. of fillings	Gross storage (Ha.m)	Recharge (ha. m)	
					Monsoon	Non monsoon
Chachrauli	1	4	90	360	90	90
Sadhaura	1	2	90	180	45	45

The kandi belt underlain by the colluviums of boulders, pebbles, cobbles mixed with clay is an area having very high permeability and porosity and thus very good scope for ground water recharge. This area is already the natural recharge area for aquifers down slope. In kandi belt of district, ground water recharge is feasible by various methods such as flooding, percolation tanks, contour bunding and tanks and ponds. In alluvial (plain) areas, various surface methods for artificial recharge are flooding, ditch and furrow, stream augmentation. Ground water recharge through injection wells, recharge pit and recharge shaft are various sub-surface methods for the plain area.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Declining water levels

There are certain areas in the district, which have recorded water level decline in recent past. Since ground water is the only source of irrigation in major part of the district, ground water aquifers are under great stress due to increased demand in irrigation and industrial sector.

Necessary remedial measures need to taken to arrest further declining of water levels in the areas and suitable methodology to be adopted to recharge the aquifers.

7.0 RECOMMENDATIONS

1. There are numerous streams through Kandi belt, which carry a lot of water during monsoon season. The rainwater can be collected in existing tanks/ponds and natural depressions and artificial surface reservoir to enhance the ground water recharge.
2. Excessive irrigation in upper reaches may lead to water level rise in downstream areas and may cause water logging in these areas.
3. Construction of shallow tubewells in areas along canals which have shallow water level and rising water level trends can help in augmenting irrigation and preventing rising water levels along canals
4. The areas having heavy water level decline need to be mapped, people made aware of adopting conjunctive use of surface and ground water, rain water harvesting and artificial recharge measures.
5. It is felt necessary to notify the over-exploited blocks i.e. Jagadhri, Mustafabad and Radaur so that the further ground water development is checked and declining of water level arrested. Local NGOs and farmers need to be educated about overexploitation of ground water.