PANCHKULA DISTRICT HARYANA

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

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Our Vision

"Water Security through Ground water Management"

GROUND WATER INFORMATION BOOKLET
PANCHKULA DISTRICT, HARYANA

C O N T E N T S

PANCHKULADISTRICT AT A GLANCE

Sl.NO.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	Geographical Area (sq. km.)	898
	Administrative Divisions	
	Number Of Tehsils (2)	1. Panchkula 2. Kalka
	Number Of Blocks (4)	1. Barwala 2. Kalka 3. Pinjore 4. Morni
	Number Of Panchayats	-
	Number Of Villages	224 inhabited 12 uninhabited
	Population (As per 2011Census)	558890
	Average Annual Rainfall (mm)	911
2.	GEOMORPHOLOGY	
	Major Physiographic Units	Siwalik hills, Kandi, Alluvial Plains
	Major Drainage	Ghaggar R.
3.	LAND USE (Sq.Km.)	
	a. Forest Area:	382
	b. Net area sown:	240
	c. Cultivable area:	340
4.	MAJOR SOIL TYPES	Sandy loams to loamy sands
5.	AREA UNDER PRINCIPAL CROPS (Sq. Km.)	140
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number Of Structures) Sq.Km	
	Dug wells	-
	Tubewells/Bore wells	70 sq.km. 4502/-
	Tanks/ponds	-
	Canals	10 sq.km.
	Other sources	-
	Net Irrigated area	80 sq.km.
	Gross irrigated area	180 sq. km.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB	
	No. of dug wells	11
	No of Piezometers	-
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium
9.	HYDROGEOLOGY	

	*Major Water bearing formation	Alluvium (Sand & Gravel)
	*(Pre-monsoon depth to water level)	8.11m- 29.44
	*(Post-monsoon depth to water level)	6.78m-29.00m
	*Long term water level trend in 10 yrs in m /yr	0.00013 to 0.0389 (Fall)
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled	
	EW	14
	OW	-
	PZ	1
	SH	-
	Depth range (m)	132.0-355m
	Discharge (liters per minute)	205-3000 lpm
	Storativity (S)	1.3 $X10^{-2}$
	Transmissivity (m^2/day)	2493-4928
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	1, 10.84mg/l
	Type of water	Alkaline
12	DYNAMIC GROUND WATER RESOURCES (2011) MCM	
	Annual Replenish able Ground water Resources	138.76
	Existing gross ground water draft for all uses	118.62
	Projected Demand for Domestic and industrial Uses upto 2025	43.79
	Stage of Groundwater Development	85%
13	a. MASS AWARENESS AND	-
	Mass Awareness Program organized	
	Date	-
	Place	-
	No of participants	-
	b. TRAINING ACTIVITY	
	Training program organized	-
	Date	-
	Place	-
	No of participants	-
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	-
	Projects completed by CGWB (No.&Amount spent)	-

	Projects under technical guidance of CGWB (Numbers)	-
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks.	- 1
	No. Semi-Critical Blocks	- 1
	No. of blocks notified	-
16	MAJOR GROUND WATER PROBLEMS AND ISSUES.	Declining of water levels Frequent Failure of tubewells

HYDROGEOLOGICAL INFORMATION BOOKLET OF PANCHKULA DISTRICT, HARYANA

1.0 INTRODUCTION

Panchkula district of Haryana is located in Northern part of Haryana State and lies between 30^o 26': 30^o 55' North latitudes and 76^o 46': 77^o 10' East longitudes. Himachal Pradesh bound the district, in North 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 898 sq. km.

Administrative setup

Panchkula district is divided into two tehsils and four development blocks viz. Pinjore, Barwala, Raipur Rani and Morni. Panchkula is thickly populated district and density of population is 522 persons per Km^2, which is higher than State average of 478 persons per Km^2. As per 2001 census the population of the district is 468411.

Drainage

The district is mainly drained by the river Ghaggar and its tributaries. A small patch of northwest part of the district is drained by northwesterly flowing Sirsa nadi, as its tributaries east - west direction before joining Sirsa nadi, which is tributary of Sutlej river.

Irrigation

Panchkula 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. Net irrigated area is $80Km^2$ whereas, gross irrigated area 180 Km^2. Percentage of gross area irrigated to total cropped area is 91.6%.

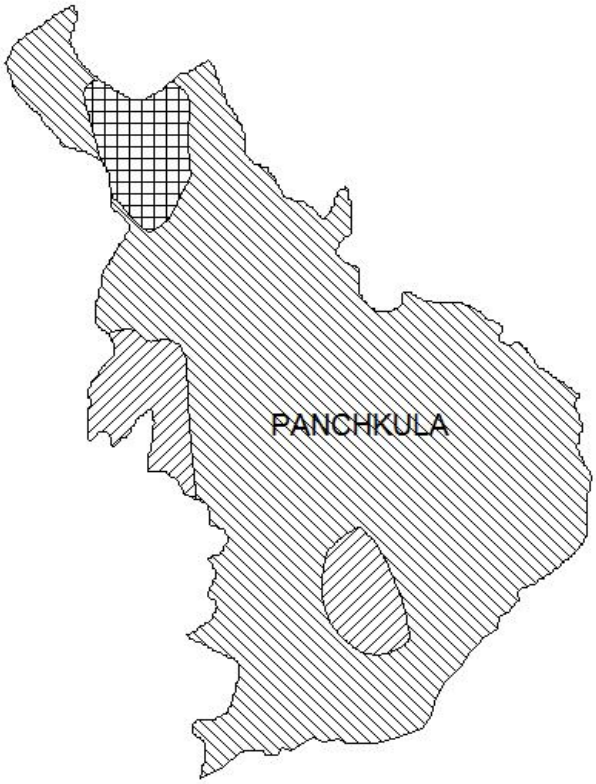
Studies carried out by CGWB

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 in the under Ghaggar Project. Ground water exploration has been carried out in various phases and so far 14 exploratory wells, (out of which 2 have yielded no water due to non-occurrence of promising zones) have been constructed in the district.

2.0 CLIMATE & RAINFALL

The climate of Panchkula 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 penetrate 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

DEPTH TO WATER LEVEL MAP
PANCHKULA
MAY 2011



LEGEND RANGE (MBGL)

- 5.0 to 10.0
- 10.0 to 20.0
- 20.0 to 30.0

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.

Rainfall

The normal annual rainfall of the district is 1057 mm, which is unevenly distributed over the area in 49 days. The southwest monsoon sets in from last week of June and withdraws in end of September, contributed about 86% of annual rainfall. July and August are the wettest months. Rest 14% rainfall is received during non-monsoon period in the wake of western disturbances and thunderstorms.

Normal Annual Rainfall	1057 mm
Normal monsoon Rainfall	911 mm
Temperature	
Mean Maximum (May &June)	39.1°C
Mean Minimum (January)	6.1 °C
Normal Rain days	49

3.0 GEOMORPHOLOGY AND SOILTYPES

3.1 Physiography

The district is divided into four Physiographic units

- Siwaliks
- Dissected Rolling Plains (Kandi)
- Alluvial Plains

Siwaliks hills

Siwalik hill ranges occupy the Northern and North-Eastern fringe of Panchkula 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 3-8 km wide and elevation varies between 250 and 375m AMSL.

Alluvial 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.

3.2 Soils 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

Water bearing formations

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 comprising 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.

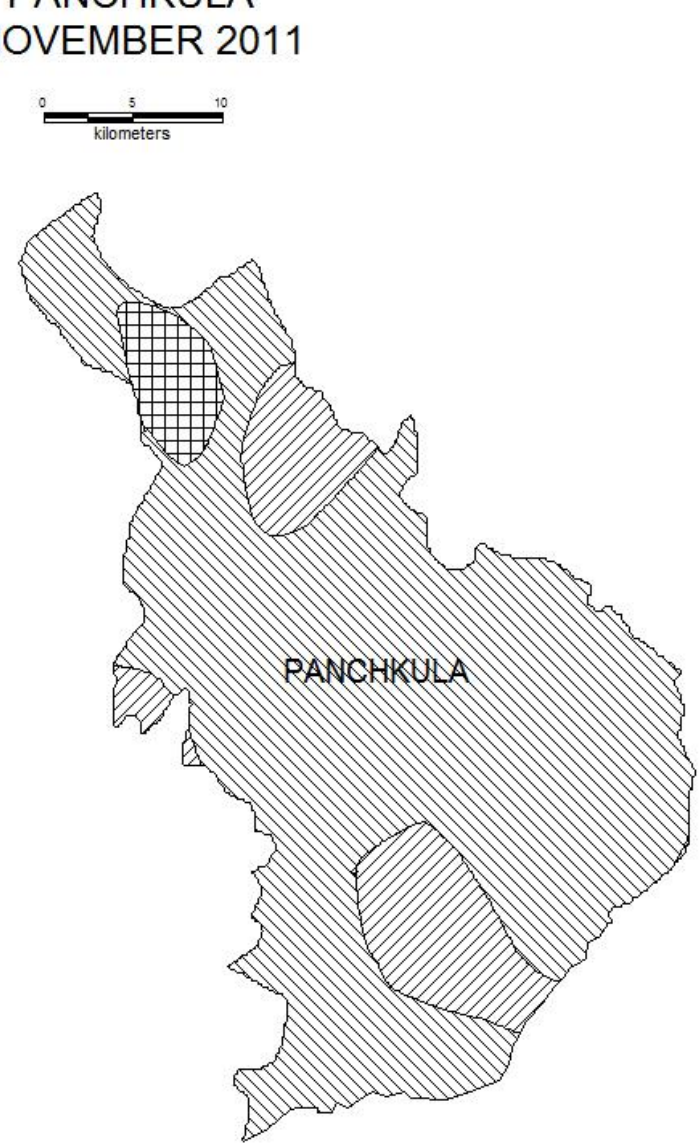
Occurrence of ground water

The ground water occurs in pore-spaces of alluvial formation including Kandi belt stretching range Siwalik foothills. In alluvium, sands, silts, kankar and gravels form potential aquifer zones in the district. The Kandi belt yet to be explored constitute of boulders, pebbles and cobbles forming major aquifer horizon.

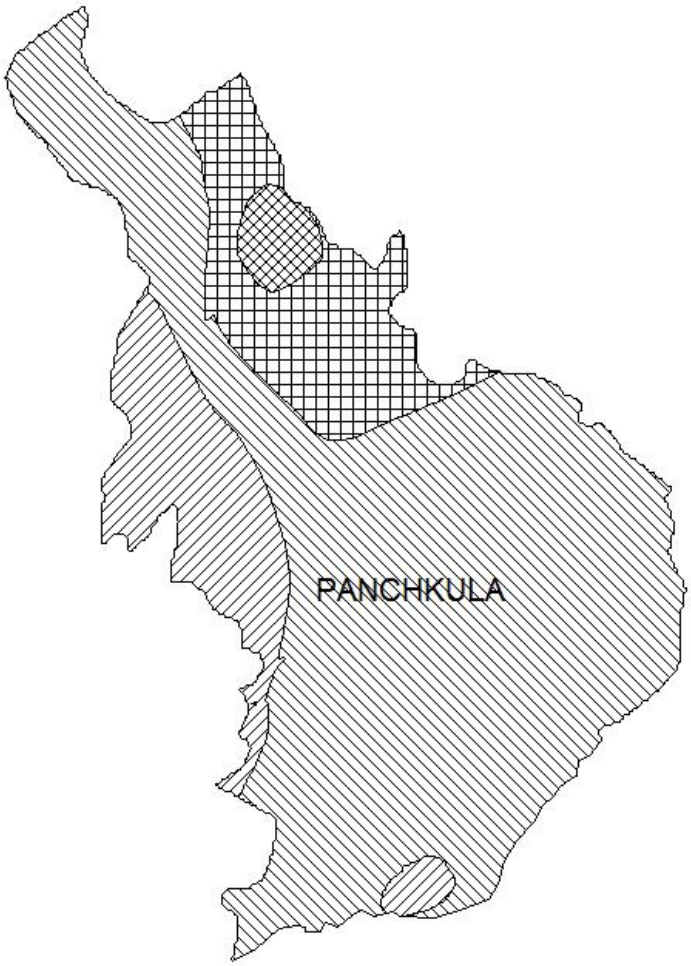
Nature and depth of ground water aquifers

In Kandi areas, the shallow aquifers are isolated lenses embedded in clay beds whereas aquifers in alluvial areas occur in 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 no. of shallow tubewells within the depth of 50m only. The discharge of these tubewells varies between 100lpm and 500 lpm for moderate drawdown values. Under ground water exploration programme fourteen exploratory wells were drilled in the district. On average 4-6 No Of granular zones have been deciphered in the depth range down to 355m bgl. Exploratory wells were drilled in depth range of 132 and 355 mbgl, yield range between 205 to 3000 lpm

DEPTH TO WATER LEVEL MAP
PANCHKULA
NOVEMBER 2011



SEASONAL WATER LEVEL FLUCTUATION MAP
PANCHKULA
MAY 2011 & NOVEMBER 2011



for Drawdown upto of 3.2 and 21.9m and Transmissivity of aquifers range between 2493 and 4928 m^2/day. Storativity of formation is $1.3*10^{-2}$

Depth to water level

The depth to water level during pre-monsoon period in the district ranges between 8.11mbgl and 29.44mbgl. The Depth to water level during post-monsoon period in the district ranges between 6.78mbgl and 29.00mbgl. However, in major part of district water level ranges between 10.0m bgl and 20.0m bgl. During last ten years, majority of observation points in the district have shown declining trends ranging from 0.00013 m/yr to 0.389m/yr, however, area as not recorded any significant rise during last ten years.

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 85% (block-Raipur Rani) to 103% (block-Barwala). The total replenishable ground water resource in the district is 138.76 mcm. The net ground water draft is 118.62 mcm. The stage of ground water development in the district is 85%.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF PANCHKULA DISTRICT, HARYANA AS ON 31ST MARCH, 2011 in ha m

Block	Net annual ground water availability (ham)	Existing gross ground water draft for irrigation (ham)	Existing gross ground water draft for all uses (ham)	Provision for domestic & industrial requirement supply to 2025 (ham)	Net annual ground water availability for future irrigation development (ham)	Stage of ground water development (%)	catagory
Barwala	5823	5430	6015	585	-192	103	OVER EXPLOITED
Pinjore	3950	905	2345	2442	603	59	SAFE
Raipur Rani	4103	2737	3502	1352	14	85	SEMI-CRITICAL
TOTAL	**13876**	**9072**	**11862**	**4379**	**425**	**85**	

4.3 **Ground Water Quality**

The ground water in the district is alkaline in nature with low to medium salinity. The chemical quality data from the shallow and deep aquifers indicate that all major cations (Ca, Mg, Na, K) and anions (CO_3, HCO_3, Cl, SO_4) are within the permissible limits set by BIS, 1991. Electrical conductivity is below 650 µs/cm in almost the entire district. Ground water

around village Kakar Majra, in the southern part of the district, has slightly higher EC of 1030 µs/cm. ground water in the district has no particular cation as dominant, while HCO_3 is the dominant anion in 56% of the samples, hence, ground water can be described as of mixed character.

Constituents	**Concentration**	
	Minimum	Maximum
pH	7.9	8.47
EC Micromhos /cm at 25 ^{0}C	220	1030
CO_3 (mg/l)	0	25
HCO_3 (mg/l)	88	288
Cl (mg/l)	7	175
SO_4 (mg/l)	0	130
NO_3 (mg/l)	0	98
F (mg/l)	0.12	0.31
Ca (mg/l)	12	61
Mg (mg/l)	2	62
Na (mg/l)	24	102
K (mg/l)	1	4
TH (Total Hardness as $CaCO_3$)	81	345

Type Of Water

The shallow groundwater is of mixed type in the district.

Suitability Of Water

Domestic

All the physical and chemical parameters are within the permissible limit prescribed by BIS. Hence, the ground water in the area is suitable for drinking purposes.

Irrigation

Suitability of groundwater for irrigation purpose is calculated by SAR and RSC values which are below 10 and 2.0 respectively in the entire district. As per USSL diagram, most of well waters fall in C2S1 class. Only two well waters fall in C1S1 and C3S1 class. These waters will cause neither salinity nor sodium hazards when used for customary irrigation.
The minor constituents such as iron, nitrate and fluoride, which are essential for plant and animal growth, are found below the permissible limit in almost the entire district. The ground water around the village Barwala has exceptionally high concentration of Iron ***(10.84mg/L).*** Similarly, the trace element arsenic is found below the permissible limit in the entire district. Thus the ground water in these areas is unfit for human consumption.

4.4 Status Of Ground Water Development

The Ghaggar is the Perennial River and descending from Himalayas in Himachal Pradesh and carries a small quantity of water in Panchkula district, only 10 Km^2 area is irrigated by the canal system, gross area irrigated in the district is 180 Km^2, whereas net area irrigated is 80 Km^2. Percentage of gross area irrigated to total cropped area is 38.3%. Nearly about 70 Km^2 of area is irrigated through 4502 shallow tube wells and pump sets, besides this there are many deep public tube wells. The discharge of shallow tube wells varies between 200 lpm and 480 lpm, whereas the discharge of deep tube wells varies between 2000 lpm and 3500 lpm. The depth of shallow tube wells ranges between 40-80m, whereas deep tube wells range up to 270m depth. Of the shallow tube wells 2070 are diesel engine operated and remaining 2432 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 hand pump as the most convenient water source to meet water shortage in villages and towns. Panchkula district has registered of **50.90%** increased in population during last one decade mainly because urbanization around Panchkula town which has put a lot of stress on water resources.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Possibility Of Artificial Recharge

The Kandi belt underlain by the colluviums of boulders, pebbles, and cobbles mixed with clay are the areas having very high permeability and porosity value and exhibit very high scope for ground water recharge. In Siwaliks, gully plugging and check dams are feasible methods of artificial recharge. 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 the flooding, ditch and furrow, stream augmentation and over irrigation. Ground water recharge through injection wells, recharge pit and recharge shaft are various sub-surface methods.

5.2 Ground Water Development

The hydro geological 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. The ground water potentials around area Kalka town have been found to be very poor, as the exploratory wells at Kalka and Badgodam have yielded little or no water. 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 bouldery formation.

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.

Tube well Failure

There are frequent cases of well failure of tube well reported from all over the district. The tube wells render max 4-5 years of service and become defunct. Their discharge either has decreased or reported to have become Silty. The shortening of life of the tube wells is due to chemical action known as incrustation. Water tends to deposit mineral on the screen surface and in the pores of the formation, thus plugging the screen opening and the pores of the formation just out side the screen thereby decreasing discharge of the tube well. The pH of water in the area is more than 7.5 and is the reason of frequent failure of tube wells.

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. The areas having heavy water level decline need to be mapped, people should be made aware of adopting conjunctive use of surface and ground water, rainwater harvesting and artificial recharge measures.
3. Parts of Raipur Rani and Barwala blocks needs special attention with regard to ground water management and development as these blocks are facing water level decline and as well as level of development is comparatively higher.