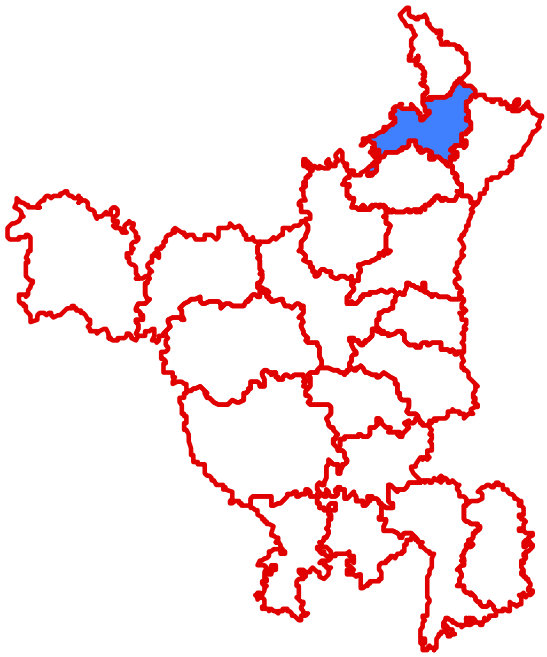
GROUND WATER INFORMATION BOOKLET

AMBALA DISTRICT HARYANA



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

CONTRIBUTORS

DINESH TEWARI

SCIENTIST `C`

PREPARED UNDER SUPERVISION OF

A. K. BHATIA

REGIONAL DIRECTOR

OUR VISION

“FRESH AND ADEQUATE WATER - FOR ALL”

GROUND WATER INFORMATION BOOKLET AMBALA DISTRICT

C O N T E N T S

AMBALA DISTRICT AT A GLANCE

Sl.No	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	1574
	ii. Administrative Divisions	
	Number of Tehsils	3-Ambala, Barara & Naraingarh
	Number of Blocks	6- Ambala I, Ambala II, Barara, Naraingarh, Shehzadpur ,Saha
	Number of Towns	15
	Number of Villages	470
	iii. Population (As per 2011 Census)	1136784
	Urban	504541
	Rural	632243
	Males	604044
	Females	532740
	Persons per sq. km	722
	% increase over 2001 - 2011	12.06
	iv. Average Annual Rainfall (mm)	1076
2.	GEOMORPHOLOGY	
	Major physiographic Units	Dissected Rolling Plain
	Major Drainage	Tangri, Beghna, Markanda
3.	LAND USE (Sq.km.)	
	a. Forest Area	52
	b. Net area sown	1060
	c. Cultivable area	1070
4.	MAJOR SOIL TYPES	Udipsamments/ Udorthents
5.	AREA UNDER PRINCIPAL CROPS	206000 ha.
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number Of Structures)	
	Dugwells	-
	Tubewells/Borewells	27042 (90000 ha.)
	Tanks/ponds	
	Canals	4000 ha.
	Other sources	-
	Net Irrigated area	106000 ha.
	Gross irrigated area	187000 ha.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB	
	No. of dug wells	8
	No of Piezometers	4

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	Sand, Gravel 2.84 -14.29 m bgl 1.04 -13.44 m bgl 0.12 -1.76 M
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW OW PZ SH	 20 - 13 3
	Depth range(m)	27.5 - 450
	Discharge(liters per minutes)	248 - 3293
	Storativity (S)	1.39×10^{-4} –1.01×10^{-1}
	Transmissivity (m^2/day)	154 - 4900
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than the permissible limit EC (micro mhos at 25°C) F (mg/l) As (mg/l) Fe (mg/l)	 3770 2.60 0.051 2.41
	Type of water	$NaHCO_3$ and Ca+Mg Mixed
12	DYNAMIC GROUND WATER RESOURCES (2011) - in ham	
	Net Annual Ground Water Availability	53252
	Net Annual Ground water Draft	46033
	Projected Demand for Domestic and industrial Uses upto 2025	8954
	Stage of Ground Water Development	86%
13	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	3
	Date	(i) 29.03.02,(ii) 30.03.05 (iii) 12.03.07 (iv) 21/22.03.2013
	Place	(i) Ambala City (ii) Police DAV Public School, Ambala Cantt. (iii) Ambala Cantt. (iv) Lakhlour
	No of participants	(i) 300 (ii) 250 (iii) 120 (iv) 150
14.	EFFORTS OF ARTIFICIAL RECHARGE& RAIN WATER HARVESTING	None
	Projects completed by CGWB (No.& Amount spent)	

	Projects under technical guidance of CGWB (Numbers)	6
15.	GROUND WATER CONTROL AND REGULATION	
	No. of Over- exploited Blocks.	3-Barara, Naraingarh & Saha
	No. Critical Blocks	
	No.of blocks notified	-
16	.MAJOR GROUND WATER PROBLEMS AND ISSUES.	Local Pondage, TW screen incrustation

GROUND WATER INFORMATION BOOKLET
AMBALA DISTRICT, HARYANA

1.0 INTRODUCTION

Ambala district of Haryana lies between 30^o 10' to 31^o 35' north latitudes and 76^o 30' to 77^o 10' east longitudes. Total geographical area of the district is 1574 sq.km. Administratively, the district is controlled by Ambala division. It is divided into three tehsils namely Ambala ,Barara and Naraingarh, and sub-divided into six development blocks namely Ambala I, Ambala II ,Barara, Shahzadpur, Naraingarh, and Saha. The district area falls in Yamuna sub-basin of Ganga basin, and is mainly drained by the river Tangri, Beghna and Markanda. The CGWB has carried out ground water exploration besides other hydrogeological studies, and mass awareness and training activities in the district.

2.0 RAINFALL & CLIMATE

The climate of Ambala district can be classified as subtropical monsoon, mild & dry winter, hot summer and sub-humid, that is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrate into the district. The hot weather season starts from mid March to last week of the June followed by the south west monsoon which lasts upto September. The transition period from September to November forms the post monsoon season. The winter season starts late in November and remains upto first week of March.

Rainfall : The normal annual rainfall of the district is 1076 mm, and is unevenly distributed over the area. The average rainy days are 44. The south west monsoon, sets in from last week of June and withdraws in the end of September, contributing about 81% of normal 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. Generally rainfall in the district increases from southwest to northeast .The mean maximum temperature is 40.8^o C(May & June) and mean minimum is 6.8^o C (January) of the district.

Rainfall

Normal Annual Rainfall	: 1076 mm
Normal Monsoon Rainfall	: 879 mm
Normal Rainy days	: 44

Temperature

Mean Maximum	: 40.8^0C (May & June)
Mean Minimum	: 6.8^0C (January)

The rainfall data of the last 5 years of Ambala District is given below:

	2008	2009	2010	2011	2012
Rainfall in mm	1228	780	1124	818	549.5
			Source: IMD		

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district area is occupied by Indo-Gangetic alluvim. There are no surface features worth to mention except that the area is traversed and drained by seasonal streams namely Tangri, Beghna and Markanda. Physiographically the area is flat terrain. However a little part in the extreme northeastern area of the district is occupied by Siwalik hills, and falls in the zone of “Dissected Rolling Plain”. The area slopes towards southwest with an average gradient of 1.5m/km. The general elevation in the district varies between 245 m to 300 m above MSL.

The soils are non-calcareous and sandy loam on the surface, and loam to clayey loam at depth, and placed under the classification of soil as Udipsamments/Udorthents.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The district is occupied by Indo-Gangetic alluvial plain of Quaternary age. The Central Ground Water Board has drilled 20 exploratory borehole, 3 slim holes, and 13 piezometers to delineate and determine potential aquifer zones, evaluation of aquifer characteristics etc. Seismic surveys conducted in the area reveal that alluvial thickness in the district is large and the basement rock is estimated to be encountered at 3000 m depth below MSL. and thickness of alluvium thins down towards southwest. In south west and western parts of the district the sediments are more fine grained in nature, and constituted of fine to medium grained sands, clays, silts and kankars with occasional gravel. The clays are usually brown to yellowish in colour and sticky to silty in nature. The sands are usually fine grained, hence it becomes difficult to develop wells so as to give sand free water with conventional well designs. Towards east and south eastern part of the district the clays are cream or light grey coloured and are soft and silty. The sands are also mostly medium to coarse grained in nature in comparison to the fine texture of sands in south western and western part of the district.

The ground water exploration revealed the presence of 3 aquifer groups down to a depth of 450 m. comprising fine to medium grained sand, clay, silt, and kankar with occasional gravel. The formation in general is fine grained in nature. The first granular zone forms the water table aquifer and occurs upto 167 m depth and is underlain by 10 to 15 m thick clay bed. The second aquifer occurs at a depth ranging between 65 to 294 m with varying thickness of 26 to 152 m. This aquifer constitutes comparatively less coarse material than the first group and is characterised by presence of *Kankar*. The third one is characterised by fine sandy beds alternating with thick clay beds at a depth ranging from 197 to 385 m exist between 180 and 205 m depth. The fourth aquifer occurs below 212 m onwards. Shallow tubewells are generally constructed upto a depth of 40 m. The discharge of shallow tubewells ranges 100 to 600 litres per minutes for a moderate drawdown. Deep tubewells constructed to a depth of 150 m yield upto 2000 to 3000 litres per minutes for 6 m to 10 m drawdown. However deeper tubewells tapping aquifer zones between150 m to 400 m depth, discharge ranges from 248 to 3293 LPM for a drawdown ranging from 2.84 to 12.93 m. Transmissivity values ranges from 154 to 4900 m^2/day, Storativity $1.39x10^{-4}$ to $1.01x10^{-1}$.

In general hydraulic conductivity values of aquifer zones decreases with depth, with in 150 m depth it is around 10 m/day and for deeper horizons between 150 m to 400 m was around 6 m/day.

4.1.1 Water level behavior

The depth to water level ranges from less than 3 m bgl to 14.29 m bgl and water level of deeper aquifer is reported up to 50 m bgl during pre monsoon period in Saha block. The water level is deep in a small area occupied by bouldary formation in the extreme north east corner of the district. The water logging condition exists in the area south west of Ambala city.

The long-term water levels trend during pre monsoon period indicates in general average decline of 0.36 m per year with a range of 0.012 m to 1.76 m . The long-term water level trend is showing a rise in little area falling in northern part of Ambala block and not of much significance being 0.10 m per year.

4.1.2 Ground water flow

The elevation of the water table in the district varies from 245 m to 300 m above mean sea level. The average gradient of the water table is of the order of 1 m/km. The overall flow of ground water is from north east to south- west direction.

4.2 Ground Water Resources

The blockwise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 65% (block-Ambala-I) to 116% (block- Barara). The total replenishable ground water resource in the district is 53252 ham, of which the net utilizable ground water resources for irrigation is 38323 ham. The net ground water draft is 46033 ham, thus leaving 5975 ham for future development. The stage of ground water development in the district is 86%.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF AMBALA DISTRICT, HARYANA AS ON 31ST MARCH 2011

Assessment Unit/Block	Net 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 uses (ham)	Allocation For domestic and industrial require-ment supply upto next 25 years (ham)	Net Ground Water Availability for future irrigation develop-ment (ham)	Stage of ground Water Develop-ment (%)	CATEGORY of Block
AMBALA I	13996	7803	1305	9108	1774	4419	65	Semi critical
AMBALA II	7275	4438	1170	5608	1516	1321	77	Critical
BARARA	6692	6449	1320	7769	1320	-1077	116	Over-exploited

NARAIN GARH	9622	8395	1620	10015	1620	-393	104	Over-exploited
SHEHZADPUR	8640	4505	1215	5720	1644	2491	66	Critical
SAHA	7027	6733	1080	7813	1080	-786	111	Over-exploited
Total	**53252**	**38323**	**7710**	**46033**	**8954**	**5975**	**86**	

4.3 Ground Water Quality

The ground water is alkaline in nature of the district. The pH values ranges from 7.07 to 10.10 indicating that the ground water is neutral to alkaline (weak base type in nature). Specific conductivity is a measure of total dissolved solids present in water and it ranges from 741 to 3500 micro/mhos at 25^0C and it is directly related to **low** values of chlorides. The fluoride (F) values ranges from0.19 mg/l to 2.45 mg/l but in general it is with in the permissible limit except at Patwi (2.45 mg/l) and Saha (2.11mg/l) in the district. Thus the ground water of the district is well within the permissible limits set by the BIS :10500: 1991 and is categorized as fresh and is suitable for domestic /drinking /irrigation purposes.

The ground water is slightly to moderately alkaline in nature. The pH values range from 7.14 at Kuralito 8.28 at Pinjola with a mean pH value of 7.75. It is moderately to highly mineralized. The EC of ground water ranges from 620 μS/cm at Ambala Cantt to 3770 μS/cm at 25°C at Pinjola. In most of the water samples, EC is below 2000μS/cm and an average EC is 1955μS/cm in the area. The hardness value of ground water ranges from 120mg/l at Panjokhera to 510 mg/l at Kakru. However, exceptionally high concentration of 901mg/l is recorded at Kurali. Among cations, the concentration of calcium ranges between 20mg/l at Pinjola and 178 mg/l at Kurali. Magnesium concentration ranges between 9.7mg/l at Panjokhera and 111 mg/l at Kurali. In majority of ground water samples, calcium and magnesium concentrations are less than 100 mg/l and their average concentrations are 84 mg/l and 45mg/l respectively. The sodium content varies widely from 83mg/l at Khan Ahmadpur to 325mg/l at Pinjola whereas potassium content ranges from 0.05 mg/l at Khan Ahmadpur to 85mg/l at Kurali. However, exceptionally high concentrations of 420 and 800mg/l are encountered at Kakru and Pinjola respectively. The average value of sodium is found to be 198.

Among anions, bicarbonate is the dominant anion. Carbonate is found to be absent whereas bicarbonate concentration is found to be ranging between 320mg/l at Panjokhera and 1051mg/l at Pinjola. Its average value is 632mg/l. The chloride concentration in most of ground water samples is within the desirable range of 250mg/l (BIS 1991) and it varies between 13mg/l at Ambala Cantt. and 375mg/l at Kurali with mean value of 175mg/l. The sulphate content in ground water ranges from 28mg/l at Khan Ahmadpur to 250 mg/l at Kurali with exception of ground water of Pinjola where its concentration is 620mg/l. The nitrate (NO_3) concentration is within the permissible limit (45mg/l) and it ranges from trace at few places to 214mg/l at Kakru with an average of 71mg/l. The fluoride (F) content in ground water of the district is less than 1.0 mg/l and it ranges between 2.53 mg/l at Naraingarh and

02.60 mg/l at Naggal. The distribution of chemical constituents in ground water I tabulated below:

Constituents	**Concentration**
pH	7.28-8.34
EC Micromhos /cm at 25 ^{0}C	435-1708
CO_3	Nil-12(mg/l)
HCO_3	268-834(mg/l)
Cl	6.7-152 (mg/l)
SO_4	20-209 (mg/l)
NO_3	Nil-75(mg/l)
F	0.30-1.33 (mg/l)
Ca	12-103 (mg/l)
Mg	2.4-34 (mg/l)
Na	35-391 (mg/l)
K	1-2.9 (mg/l)
Total Hardness as $CaCO_3$	40-267 (mg/l)

Plot of USSL diagram used for the classification of irrigation water indicated that ground water in district Ambala fall under classes C_2S_1, C_3S_2 and C_4S_1 may leading to low to vary high salinity hazards, while these may not cause sodium hazards because of low SAR. About 29% water samples having C_4S_2, and C_4S_3 classes, may lead to salinity as well as sodium hazards when used for irrigation under normal practices. However, such type of water can be used for irrigation along with an appropriate quantity of gypsum or can be used for irrigating salt tolerant crops grown on soils with adequate permeability. Classification based on RSC indicates that ground water in 14% of the samples is safe, in 28% marginal and in the remaining 56% samples ground water is unsafe for irrigation use.

Type of water

The shallow ground water in the district is of $CaHCO_3$ type. In Shehzadpur and Patwi areas the water is of $NaHCO_3$ type, while at Pinjola it was $KHCO_3$ type. At Kakru mixed facies type of water occurs.

Suitabilty of water

Domestic

Ground water occurring in the shallow aquifer is by and large potable except at few places where salinity has rendered the water unfit for drinking purposes.

Irrigation

Most of the well waters are suitable for irrigation. At some places such as Patwi,Kakru, Mohra and Shahzadpur, ground water is marginally alkaline or sodic

4.4 Status of Ground Water Development

Ground water development in the district has taken place through private and public agencies for both irrigation and drinking purposes. The Cantonment Board has constructed tubewells of varying depths ranging from 297m to 349m for drinking water supply to the Ambala Cantt. The other towns –Naraingarh, Barara and Shehzadpur are also provided piped water by the PHE. Deptt., Haryana. The deep tubewells are of about 150 m depth and yield 2000 to 3000 lpm. The water supply to the villages is meet out with the installation of hand pumps by the villager as spot and convenient source of water. Beside canal irrigation there are 21,917 minor irrigation units in the district to meet out the irrigation demand of water. Most of the shallow tube wells are either run by diesel engines or electric motors. These tubewells are generally 40 m deep with discharge of the order of 100-600 lpm.

Causes of tubewell failure:

There are cases of frequent failure of tube wells constructed using MS pipe assembly in the Ambala Cantonment area. Tube wells in this area run for as low as $3^1/_2$ years to a maximum of 8 years beyond which their discharge either decreases or become Silty (as reported). 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 the iron is more than 2.0 mg/l are the source of incrustation and is the cause of frequent failure of tube wells. The periodic muriatic acid treatment can reduce incrustation thereby reducing plugging of screen openings, and enhancing life of the tube wells. PVC pipes used in the construction of shallow tube wells are successful in the area.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The hydrogeological data generated through exploratory test drilling has provided 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 305/203mm dia. Combination, using about 80m to 90m housing length having slot size of 1.19 mm would be ideal for the district area. The “V” wire galvanized Johnson Screen having 1.0mm slot width may also be used against granular zones, as it has more open area for the entrance of water. The shallow tube wells upto 40 m depth should have 203 mm single dia. pipe assembly with a suitable screen length. Direct Rotary rig can carry out the drilling in the district area except in a small bouldary area where Percussion rig is required for the purpose.

5.2 Water Conservation and Artificial Recharge

Central ground Water Board has provided technical guidelines in formulating and promoting the artificial recharge and rainwater harvesting projects for Military Engineering Service /Indian Air Force, Ambala Cantt..

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Local Pondage

An area of about 30 sq.km. is water logged. There are some depressions in the district mainly located in and around Ambala city. The rainwater is collected there during the rainy season. Thus these areas are prone to storage of water and render the land useless. Such areas are to be reclaimed as their dimensions are increasing year after year. This water can be diverted to deep water level and water level decline areas and artificially recharged to ground water.

High pH and Iron (Fe)

The high value of pH and Iron concentration has created incrustation on MS pipe assembly, thereby causing well failure in parts of district area. The MS pipe assembly generally used in construction of the deep tubewells be given periodic muriatic acid treatment to enhance the life of the tubewell. The shallow tubewells can be constructed using PVC pipe.

7.0 AWARENESS & TRAINING ACTIVITY

Mass awareness Programme (MAP)

Mass Awareness Programme was held on Water Resources Day during 2000 at Ambala city on 29.03.2000. The theme of the programme was “Water for life” Various activities were carried out during the programme as given below:-

a) The exhibition was inaugurated by Shri Nirmal Vij, President Municipal Council Ambala city and was widely covered by the press. A large number of maps, charts etc were displayed .114 children participated in painting and elocution competition. A quiz competition was held for the children and prizes were distributed for all correct answers.
b) The seminar was organized between 3PM to 5PM Shri Chander Singh, IAS, Commissioner Ambala district was the chief guest .Smt Veena Chibber , MLA Ambala and Shri Jasbir Singh Malore , MLA Nagal graced the occasion . An audience of above 300 people constituting members from public school children, teachers, officers from PHED, HSMITC, Survey of India, MES, Railways, telephones etc attended the celebrations.
c) The Regional Director, NWR, CGWB Chandigarh addressed the gathering. The problems were highlighted. Special emphasis was given on declaration of Ambala Municipal faced by Haryana in general and Ambala in particular in respect of water resources Corporation as notified area for the purpose of registration of ground water

abstraction structures. Need for regulation of ground water abstraction and protection against pollution was publicized.

d) The distinguished guest lauded the role of the CGWB in development and protection of ground water resource of Haryana and expressed full co- operation.

e) The Chief Guest distributed prizes to winners of all contents. He appreciated the efforts made by the CGWB and extended wholehearted support to the cause of protection of the ground water resource of the notified area.

A mass awareness programme was held at Police DAV Public School, Ambala, Haryana on 30.3.2005 to create awareness amongst the students, farmers, and State Govt. officers about water conservation, protection and management of ground water. In this regard a painting competition on various ground water themes was held in three categories of students. 150 students from various schools participated in the competition. The programme was attended by about 250 officers of the various State Govt, Deptt, farmers, teachers, and students. Sh. J.P.Kaushik, Dy. Commissioner, Ambala was the chief guest of the programme. During his address he emphasised the need for conservation of water for future generation. Sh. S.S.Dhaiya DFO, Ambala delivered a lecture on availability of water for a common man. Lectures on water conservation and artificial recharge to ground water was delivered by Sh. V. M. Sikka, Regional Director, and Sh. A. K. Bhatia, Scientist 'D'. The programme was covered by Press media. Participation certificates and prizes were given to the students.

Mass Awareness Programme was organized on 12.03.2007 at Ambala Cantonment. The awareness programme was specially organized for Army Officers at Kharga Auditorium, Ambala Cantonment and 120 officers and officials attended the programme. Shri K.Majumdar, Sub area Commander, Amabla Cantt. was the chief guest. During the programme a brief history of activities of Central Ground Water Board was given by Shri GP Singh , AHG . Keynote address on Ground Water Management and Rainwater Harvesting and Artificial recharge to Groundwater was delivered by Shri Sushil Gupta, Regional Director. During the address on ground water scenario of the Haryana State was elaborated and stress was laid on groundwater management and rainwater harvesting and artificial recharge to ground water. Shri S. Marwaha, Scientist `D` delivered a lecture on various techniques of rainwater harvesting and artificial recharge to groundwater. Special emphasis was given on various techniques of Rainwater Harvesting applicable to Ambala Cantonment area. A film of "Rainwater Harvesting in Urban areas" was also shown during the programme. An exhibition showing various activities of Central Ground Water Board had been put up. Defence officers had shown keen interest in various lectures and projects undertaken by Central Ground Water Board.Shri K. Mujumdar, Sub area Commander thanked Central Ground Water Board for organizing an awareness programme for army and requested to army officers to adopt rainwater harvesting in their units. He also requested the army officers for organizing such awareness programmes for conservation and artificial recharge to groundwater at Ambala Cantt.

8.0 RECOMMENDATIONS

1. There are depressions in and around Ambala city in which rainwater is collected. This storage can be used for artificial recharge by diverting the water to deep water level areas. In order to arrest the declining trend of water levels in the district, the

rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir.

2. The construction of roof top rainwater harvesting structures should be made mandatory in building bye-laws, which will help in checking the falling water level trend in the towns of water level depleting areas.
3. There is a rise in water level along canal due to existing canal system, which is worked out to be 0.7 m per year and creates water logging conditions. Hence, the canals may be lined.
4. The pH of water is more than 7.5 and, Iron is more than 2 mg/l causing incrustation of well screen in deep tube wells at places in the district area and thereby shortening the life of tubewells. The periodic muriatic acid treatment of well assembly is required.
5. PVC pipe assembly may be used in case of shallow tubewells.
6. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.
7. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited blocks.

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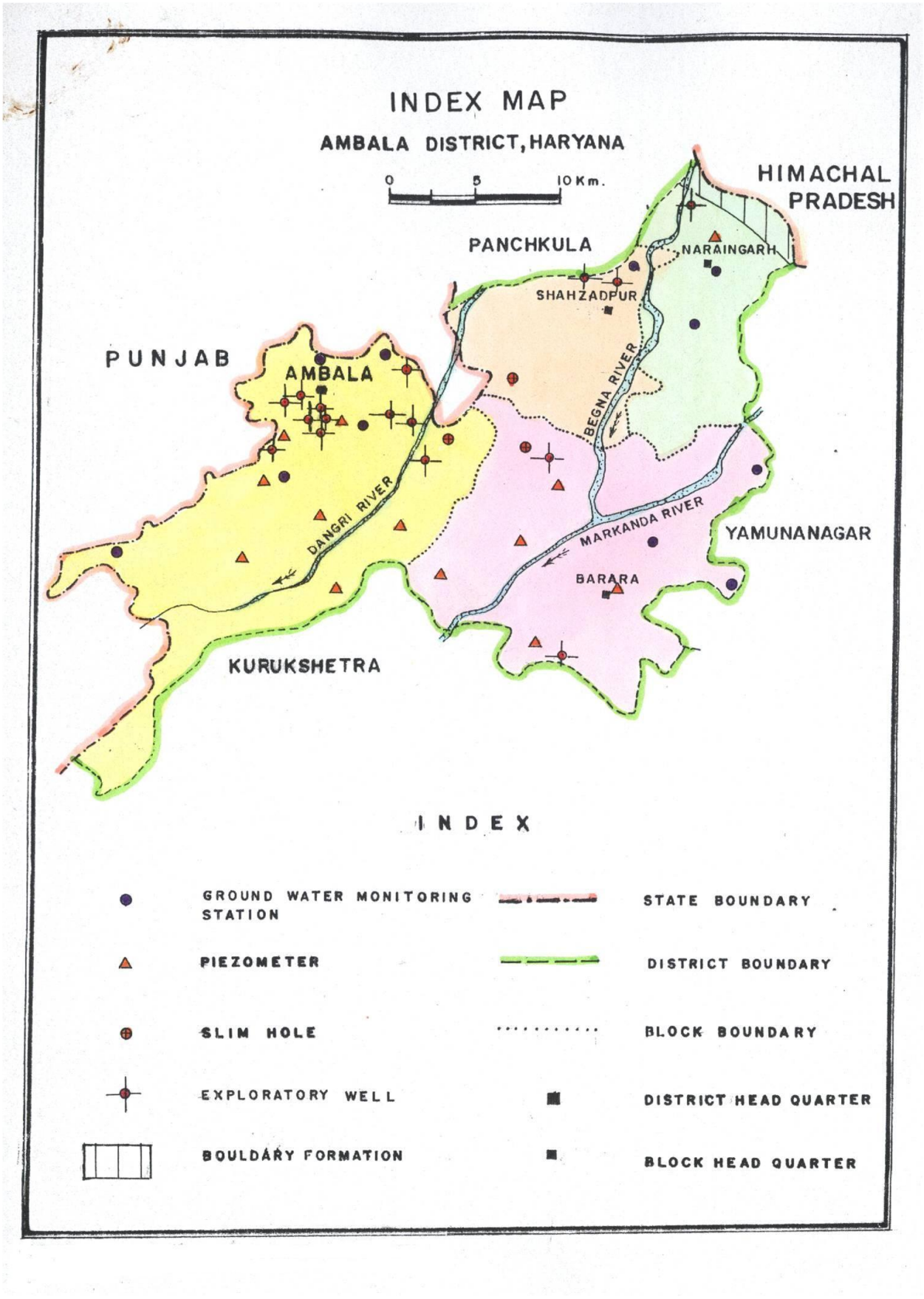
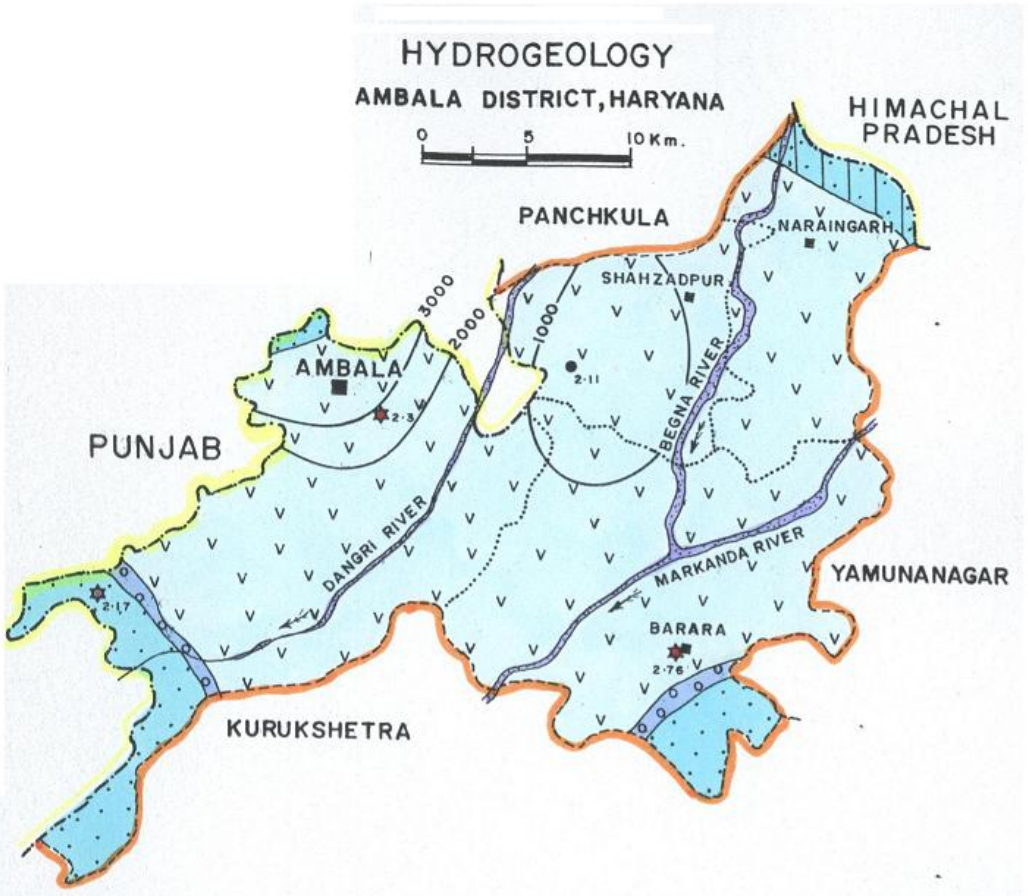

INDEX MAP
AMBALA DISTRICT, HARYANA
0
5
10 Km.
HIMACHAL PRADESH
PANCHKULA
NARAINGARH
SHAHZADPUR
PUNJAB
AMBALA
BEGNA RIVER
DANGRI RIVER
MARKANDA RIVER
YAMUNANAGAR
BARARA
KURUKSHETRA
INDEX
GROUND WATER MONITORING STATION
PIEZOMETER
SLIM HOLE
EXPLORATORY WELL
BOULDARY FORMATION
STATE BOUNDARY
DISTRICT BOUNDARY
BLOCK BOUNDARY
DISTRICT HEAD QUARTER
BLOCK HEAD QUARTER



INDEX

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL(m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	50 — 440	480 — 3200	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 — 100	360 — 480	RECHARGE TRENCH AND RECHARGE SHAFT
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 — 60	240 — 360	RECHARGE TRENCH AND RECHARGE SHAFT

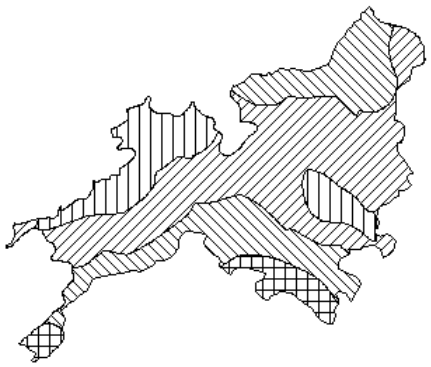
ELECTRICAL CONDUCTIVITY (MICROMHOS/CM AT 25°C)

1000

2·76 IRON > PERMISSIBLE LIMIT (1·0 ppm)

2·11 FLUORIDE > PERMISSIBLE LIMIT (1·5 ppm)

DEPTH TO WATER LEVEL (PRE- MONSOON 2011)



< 2.0

2.0 to 5.0

5.0 to 10.0

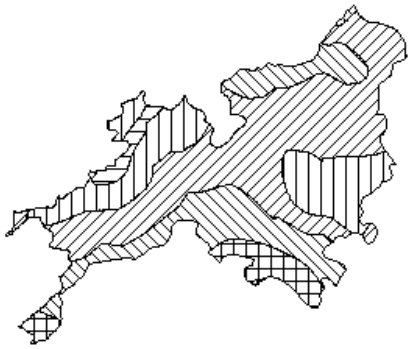
10.0 to 20.0

20.0 to 30.0

30.0 to 40.0

> 40.0

DEPTH TO WATER LEVEL
(POST- MONSOON 2011)



< 2.0

2.0 to 5.0

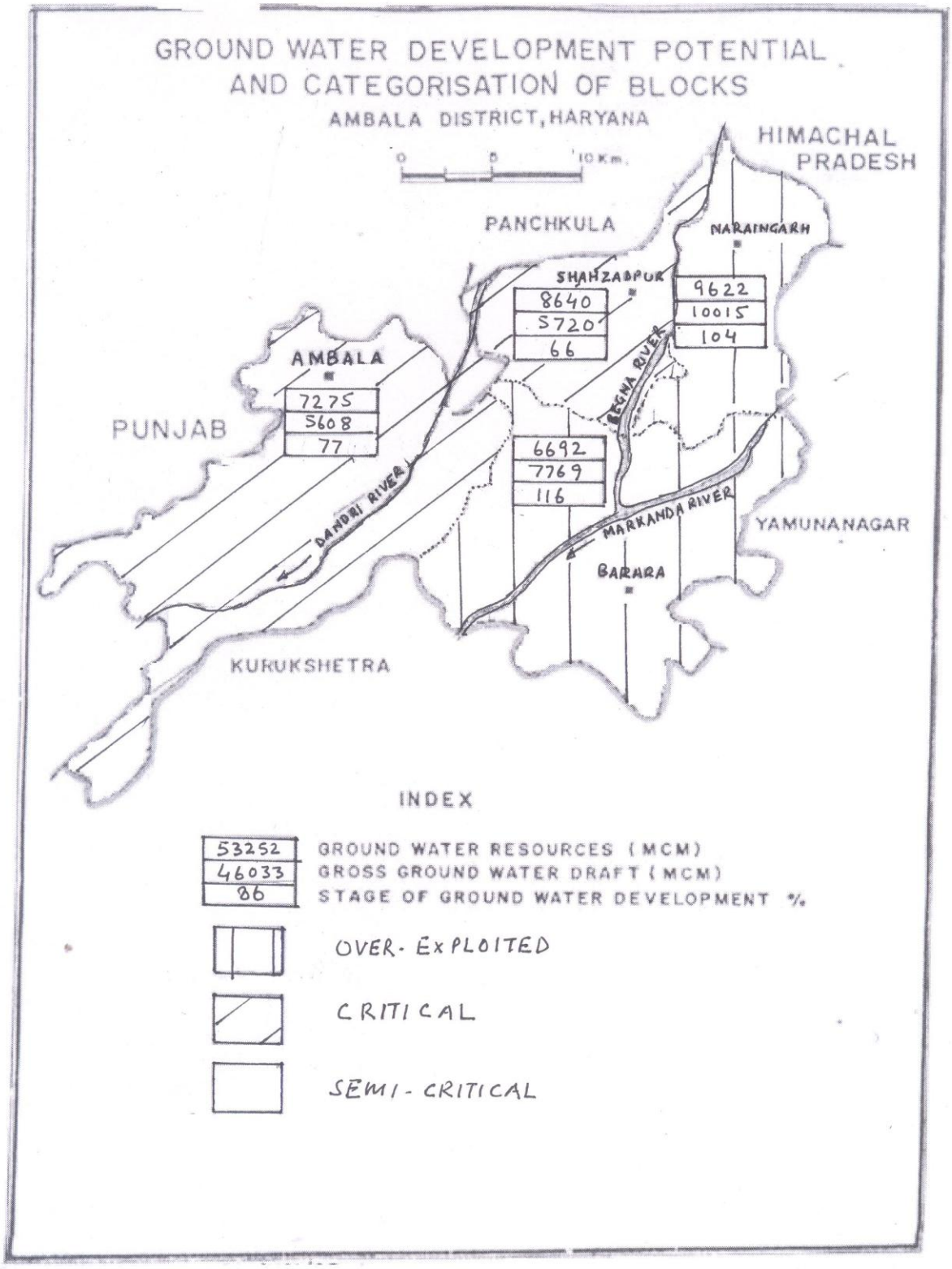
5.0 to 10.0

10.0 to 20.0

20.0 to 30.0

30.0 to 40.0

> 40.0


GROUND WATER DEVELOPMENT POTENTIAL
AND CATEGORISATION OF BLOCKS
AMBALA DISTRICT, HARYANA
0 5 10 Km.
HIMACHAL PRADESH
PANCHKULA
NARAINGARH
SHAHZADPUR
8640
5720
66
9622
10015
104
AMBALA
7275
5608
77
PUNJAB
6692
7769
116
RAKSHA RIVER
DANDRI RIVER
MARKANDA RIVER
YAMUNANAGAR
BARARA
KURUKSHETRA
INDEX
53252
46033
86
GROUND WATER RESOURCES (MCM)
GROSS GROUND WATER DRAFT (MCM)
STAGE OF GROUND WATER DEVELOPMENT %
OVER-EXPLOITED
CRITICAL
SEMI-CRITICAL