PATIALA DISTRICT PUNJAB

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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Regional Director

Our Vision

"Water Security through Ground water Management"

GROUND WATER INFORMATION BOOKLET

PATIALA DISTRICT, PUNJAB

C O N T E N T S

PATIALA DISTRICT AT A GLANCE

Sl.No	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	3218
	ii. Administrative Divisions	
	Number of Tehsils	05- Patiala, Nabha, Ghanaur, Rajpura and Samana
	Number of Blocks	08- Patiala, Nabha, Sanaur, Bhunerheri, Rajpura, Ghanaur, Samana and Patran
	Number of Panchayats	-
	Number of Villages	1084
	iii. Population (As per 2011Census)	18,92,282
	iv. Average Annual Rainfall (mm)	677
2.	GEOMORPHOLOGY	
	Major physiographic Units	Plain
	Major Drainage	Ghaggar River
3.	LAND USE (Sq.km.)	
	a. Forest Area	120
	b. Net area sown	2630
	c. Cultivable area	2810
4.	MAJOR SOIL TYPES	Tropical arid brown and arid brown
5.	AREA UNDER PRINCIPAL CROPS	5190 sq.km.
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number Of Structures)	
	Dugwells	-
	Tubewells/Borewells	2570 sq.km (80607)
	Tanks/ponds	-
	Canals	60 sq.km
	Other sources	-
	Net Irrigated area	2630 sq.km.
	Gross irrigated area	5177 sq.km.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB	
	No. of dug wells	09
	No of Piezometers	04
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 4.43- 20.62mbgl 6.99 - 24.28mbgl 0.16m-1.07m (Fall) 0.00 - 0.24 m. (Rise)
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW OW PZ SH	 10 - 06 -
	Depth range(m)	49-400
	Discharge(liters per minutes)	2400-2680
	Storativity (S)	$1.95x10^{-3}$ -4.7x10-3
	Transmissivity (m^2/day)	154-9410
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)	 667-4100 0.20-2.80 0.10 to 0.75 0.0002 to 0.0023
	Type of water	Na HCO_3 & mixed type
12	DYNAMIC GROUND WATER RESOURCES(2009)-in MCM	
	Annual Replenishable Ground water Resources	1490.83
	Net Annual Ground water Draft	2911.65
	Projected Demand for Domestic and industrial Uses upto 2025	64.54
	Stage of Ground Water Development	195%
13	AWARENESS AND TRAINING ACTIVITY	One Mass Awareness organized at Patiala on 28th March 2003
14.	EFFORTS OF ARTIFICIAL RECHARGE& RAIN WATER HARVESTING	Four pilot projects for artificial recharge to ground water and one roof top rain water harvesting.
15.	GROUND WATER CONTROL AND REGULATION	
	Number of Over Exploited Blocks.	08
	No. Critical Blocks	-
	No.of blocks notified	1
16	.MAJOR GROUND WATER PROBLEMS AND ISSUES.	Ground water salinity, Water level decline, High Fluoride

GROUND WATER INFORMATION BOOKLET
PATIALA DISTRICT, PUNJAB.

1.0 INTRODUCTION

Patiala district of Punjab state lies between 29^o 49' 30^o 40' north latitudes and 75^o 58' 76^o 48' east longitudes. Total geographical area of the district is 3218 sq.km. The Patiala district is divided into five sub-divisions (tehsils) namely Patiala, Nabha, Ghanaur, Rajpura and Samana comprising eight-community development blocks viz. Patiala, nabha, Sanaur, Bhunerheri, rajpura, ghanaur, samana and Patran for the purpose of administration .The district headquarter, Patiala town falls in Patiala Tehsil.

2.0 RAINFALL &CLIMATE

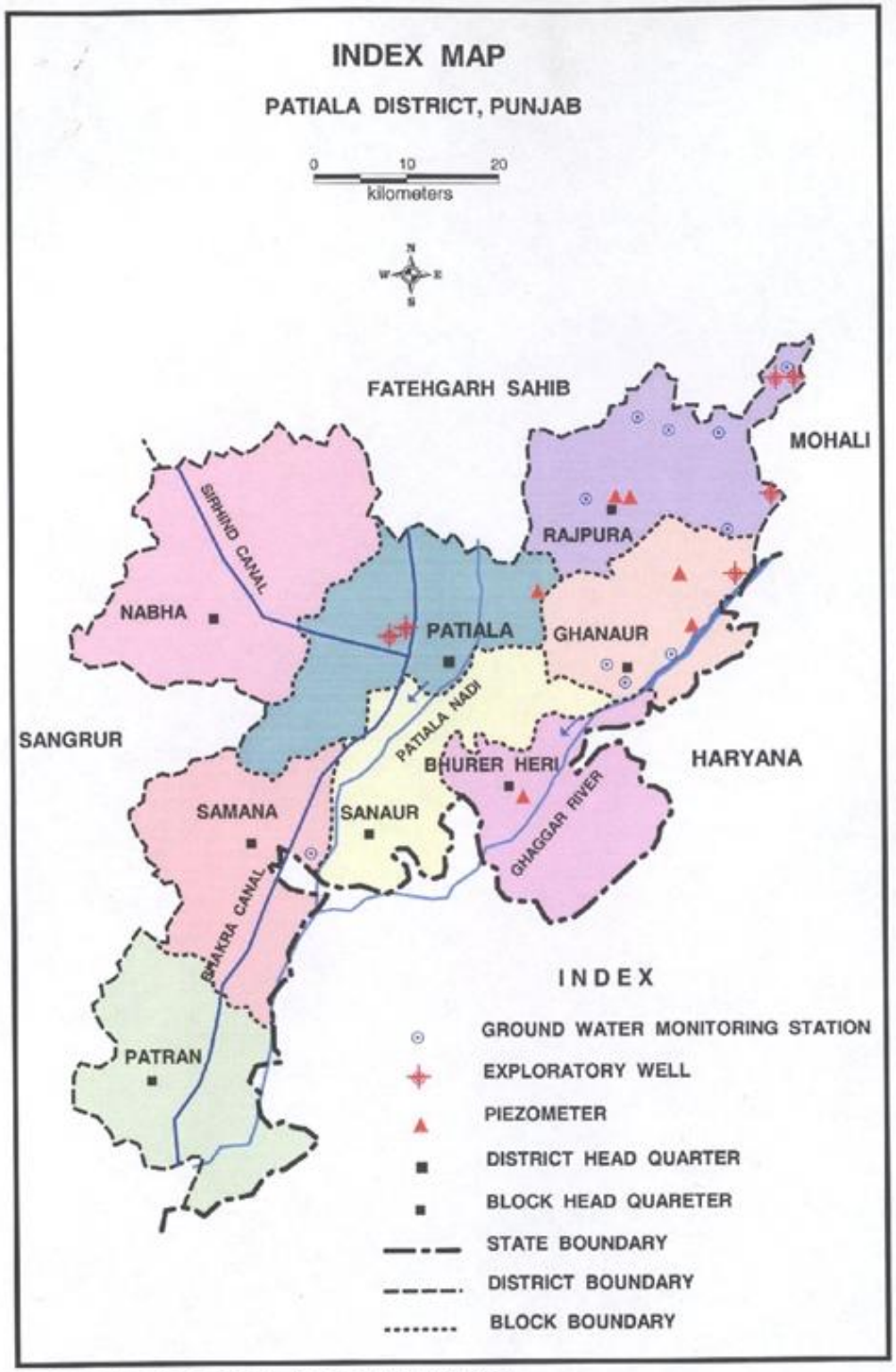
The climate of Patiala district can be classified as tropical steppe, Semi-arid and hot which is mainly dry with very hot summer and cold winter except during monsoon. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south west monsoon which lasts upto September. The transition period from September to October forms the post monsoon season. The winter season starts late in November and remains upto first week of March.

The normal monsoon and annual rainfall of the district is 547 mm and 677 mm , respectively which is unevenly distributed over the area 29 days.. The south west monsoon, sets in from last week of June and withdraws in end of September, contributing 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. Generally rainfall in the district increases from southwest to northeast.

The mean minimum and maximum temperature in the area renges from 7.1^o C to 40.4^o C during January and May or June respectively.

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district area is occupied by Indo-Gangetic alluvial plain and consists of three types of region viz. the Upland plain, the Cho-infested Foothill Plain and the Floodplain of the Ghaggar river. The elevation of land ranges from 240 to 278 m amsl. Due to arid climate, the soils are light coloured. Tropical arid brown soils exist in the major parts of the district. Here soils are deficient in nitrogen, phosphorus and potassium. In Patran and Samana blocks, soils are arid brown soils occur. These are calcareous in nature and in most cases kankar layers occur.



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4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The district is occupied by Indo-Gangetic alluvial plain of Quaternary age, and falls in Ghaggar basin. The ground water occurs in alluvium formations comprising fine to coarse sand, which forms the potential aquifers. In the shallow aquifer (up to 50m) ground water occurs under unconfined/water table conditions, where as in deeper aquifer, semi-confined/confined conditions exist.

The traditional dugwells tapping the shallow aquifer are not in use and most of them have been abandoned, however, this aquifer is being tapped by thr hand pumps and shallow tube wells, which are widely used for domestic purposes. The deep tube wells have been constructed by CGWB, which has drilled 10 exploratory boreholes, 1 slim hole and 6 Piezometers to delineate and determibne potential aquifer zones, evaluation of aquifer characteristics.The deepest slim hole was drilled up to the depth of 308.30 at Dhappar (30^{o} 31'00" 76^{o} 48'24"). EW at Chamaru(Rajpura) Theri(Sanaur) Seel (Ghanaur) Mallomajra(Patiala)Thuhi(Nabha) The permeable granular zones comprising fine to mediumgrained
sand and occasionally coarse sand and gravel.Their lateral and vertical extent is limited. The borehole data reveals that clay group of formations dominate 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.

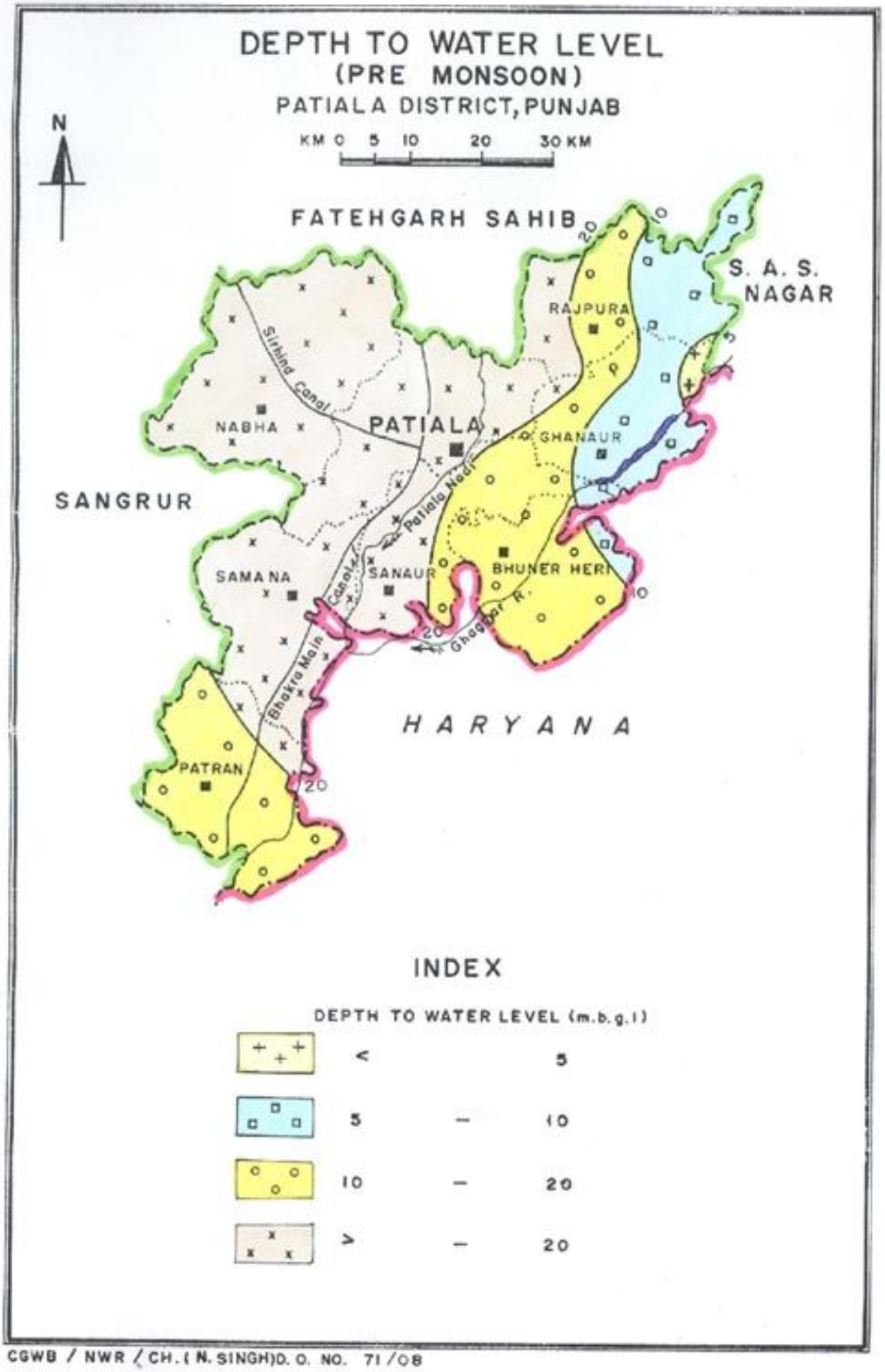
The discharge of deep tube well in the area varies between 2400 and 2680 lpm. The transmissivity values ranges from 154 to 9410 m^2/day and storativity ranges from $1.95*10^{-3}$ to $4.7*10^{-3}$.

Water level behavior

The depth to water level ranges from 4.43 to 20.62 m bgl during pre monsoon period and 6.99 to 24.28 m bgl during post monsoon period. The seasonal fluctuation varies from 0.03 to (-) 3.66 m in the area. The long-term water levels trend indicates average fall of 0.50 m/year.The long term water level trend is also showing little rise being 0.24 m/year around majauli, which insignificant with respect to entire area.

Ground water flow

The elevation of the water table in the district varies from 230 m to 300 m above mean sea level.The highest elevation is in the northeastern part and the lowest in the southwestern part and reflects the topographic gradients. The hydraulic gradient in the northern eastern part is steep, whereas, in the southwestern part, it is gentle. The The overall flow of ground water is from
northeast to south-west direction.



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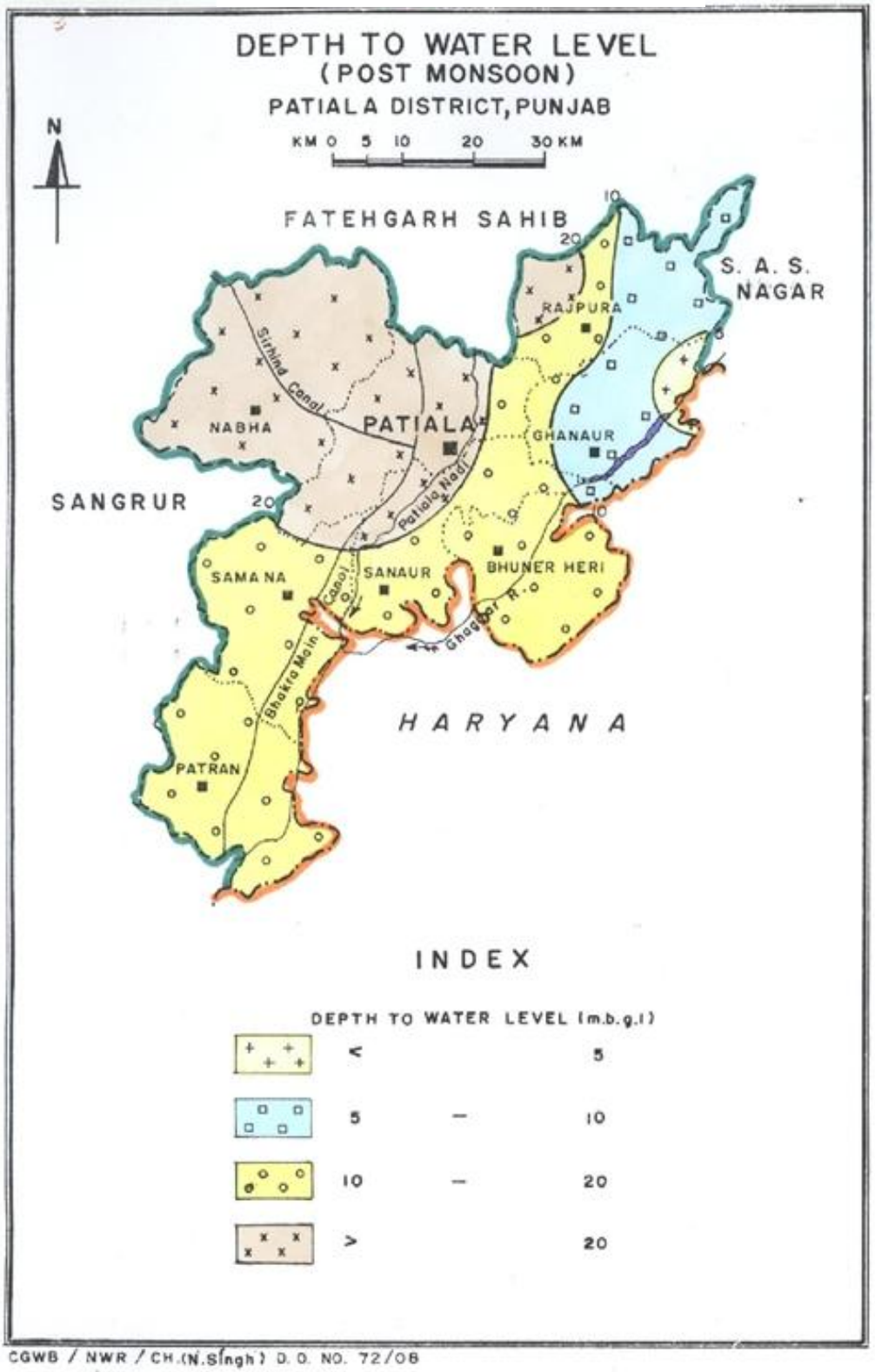

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4.2 Ground Water Resources

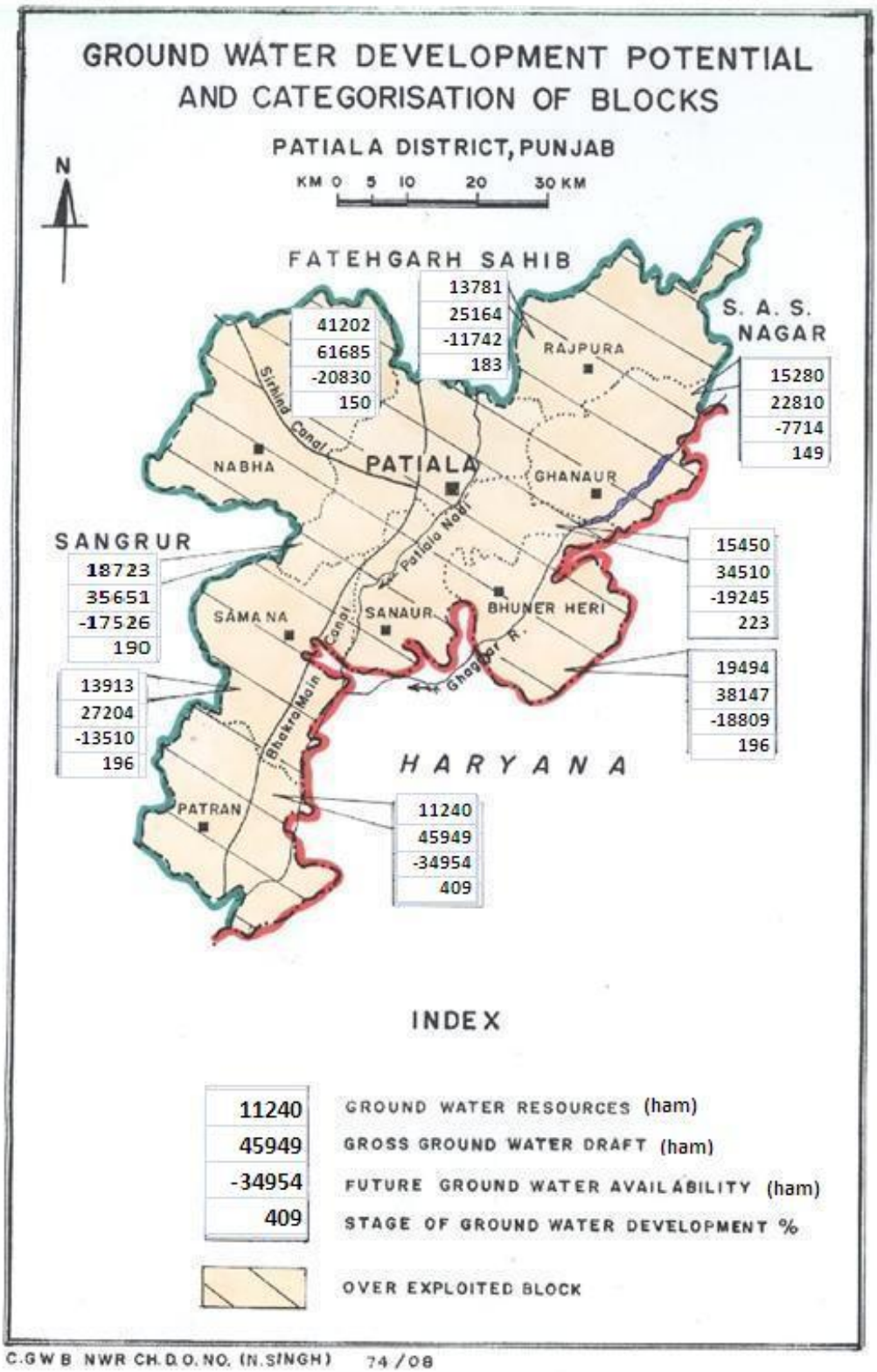
The blockwise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 149% (Ghanaur) to 409% (Patran).The net ground water resource of Patiala district have been estimated to be 1490.83 MCM and the gross ground water draft of the district is 2911.65 mcm leaving behind a shortfall of 1443.30 MCM. The stage of ground water development in the district is 195%.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF PATIALA DISTRICT, PUNJAB (AS ON 31ST 31-03-2009)

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
Bhunerheri	19494	37863	284	38147	440	-18809	196	Over Exploited
Ghanaur	15280	22475	335	22810	519	-7714	149	Over Exploited
Nabha	41202	60944	741	61685	1088	-20823	150	Over Exploited
Patiala	18723	34562	1089	35651	1687	-17526	190	Over Exploited
Rajpura	13781	24509	655	25164	1014	-11742	183	Over Exploited
Samana	13913	26604	400	27204	620	-13510	196	Over Exploited
Sanaur	15450	34172	338	34510	523	-19245	223	Over Exploited
Patran	11240	45631	363	45994	563	-34954	409	Over Exploited
TOTAL	**149083**	**286960**	**4205**	**291165**	**6454**	**-144330**	**195**	**Over Exploited**

4.3 Ground Water Quality

CGWB has carried out studies for chemical quality of ground water in the area. The ground water of the district is alkaline in nature. The EC in the area ranges from 687 to 4100 Micromhos /cm. Nitrate values ranges between 0.40 to 200 mg/l and fluoride concentration ranges from 0.20 to 2.8 mg/l.At few places high fluoride and nitrate have been observed, thus the ground water in these places is harmful for human consumption. The range of mineral concentration is tabulated below.



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Constituents	Minimum limit	Maximum limit
pH	7.10	8.24
EC Micromhos /cm at 25 ^{0}C	687	4100
Alkalinity (mg/l)	195	810
CO_3 "	Nil	Nil
HCO_3 "	238	988
Cl "	21	379
SO_4 "	37	1260
NO_3 "	0.40	200
F "	0.44	2.8
Ca "	12	130
Mg "	1.2	81
Na "	116	778
K "	1.4	205
B "	0.14	0.54
TH as $CaCO_3$ "	35	657
As "	0.0002	0.0022
Fe "	0.10	0.75
SAR	3.00	14.01
RSC	-7.37	12.17

Type of water

The shallow ground water is of $NaHCO_3$ type and mixed facies type of water also occurs where EC increases in district.

Suitabilty of water

Ground water is potable and fit for drinking and domestic purposes, except at few places, where high values of nitrates and fluoride is observed.

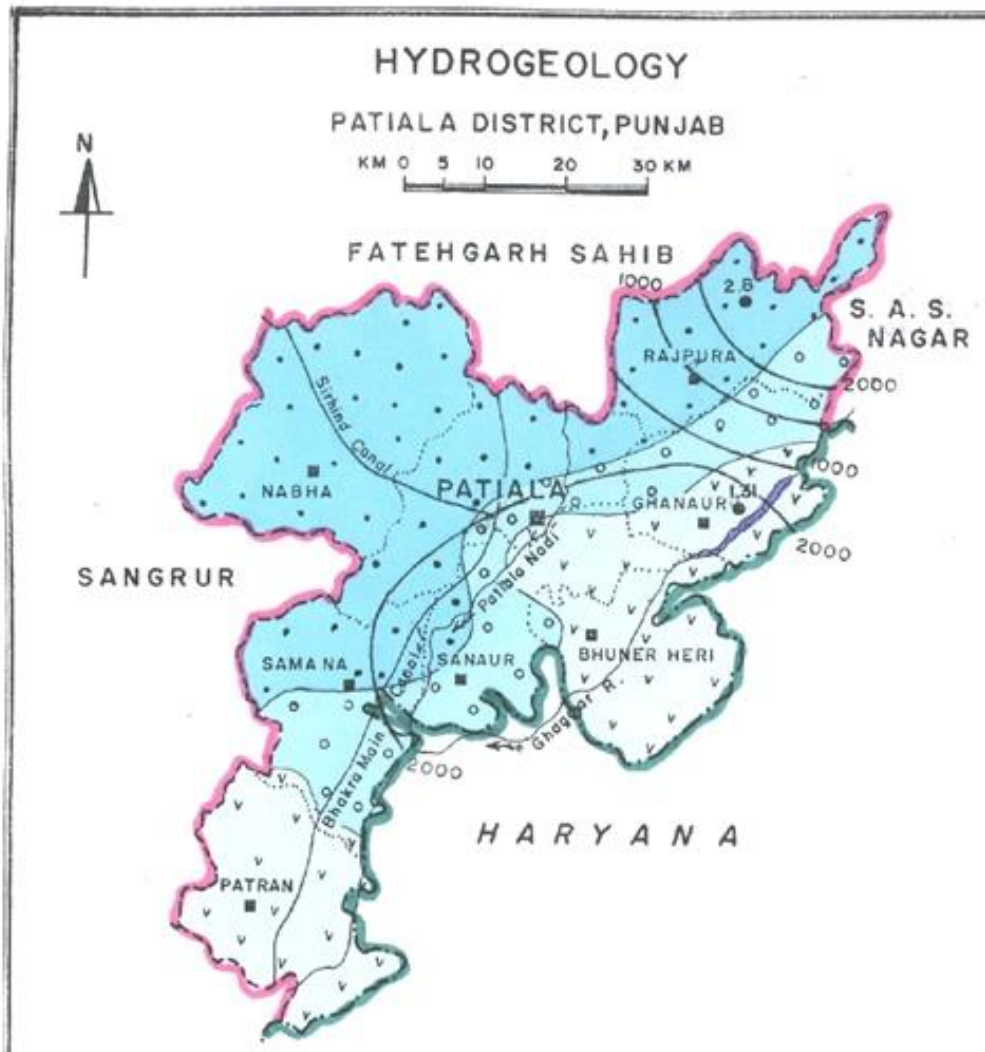
The suitability of ground water for irrigation purpose is calculated by SAR and RSC values, which range between 3.00-14.01 and -7.37-12.17 respectively. The ground water in the area is C_3 and C_4 type from salinity point of view and S_1 and S_2 type from solidity point of view; as such ground water is fit for irrigation.

4.4 Status Of Ground Water Development

The drinking water supply is mainly through ground water in the district. The short fall in water supply to towns, cities and villages is met with the installation of hand pumps by public individually as spot and convenient source of water. The shallow tube wells tap unconfined aquifer and depth varies from 20 to 70 m.The tube wells constructed by the municipal corporation and other agencies have been constructed tapping deeper aquifer down to 100m. The shallow tube wells irrigate about 2670 sq.km. area in the district. Most of these shallow tube wells are cavity type and either run by diesel engines or electric motors. he discharge of these shallow tube wells/cavity wells range 600 - 1000 lpm.

HYDROGEOLOGY

PATIALA DISTRICT, PUNJAB



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	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	35 – 300	> 1280	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	50 – 220	960 – 1280	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 – 160	480 – 960	RECHARGE TRENCH WITH INJECTION WELL

ELECTRICAL CONDUCTIVITY (MICROMHOS/CM AT 25°C)

1000

2.6 ● FLUORIDE > PERMISSIBLE LIMIT (1·0)

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5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The present stage of ground water development varies from 149% (Ghanaur) to 409% (Patran). All the eight blocks of the area fall in Over Exploited category. Hence, there is no scope of large-scale ground water resource development in the area .However, the shallow ground water can be exploited with caution through shallow tube wells (Cavity Type). PVC pipes are commonly used for constructing these tube wells. Drilling technique used for boring the shallow wells is locally developed.

5.2 Water Conservation and Artificial Recharge

In Patiala district, 4 pilot projects for artificial recharge to ground water were undertaken and same were completed successfully. These are namely (i). Pilot project for Artificial Recharge from Choe No.1 of Bhakra Main line canal, near village Dhanetha, Samana block (1999-2000), (ii) Pilot study for artificial recharge scheme to ground water from Sirhind Choe, (2000 - 2001), Pilot study for artificial recharge to ground water from Patiala Nadi (2001-2002) and Pilot study for artificial recharge to ground water from Miranpur choe (2001-2002). One Scheme for artificial recharge to roof top rain water harvesting for school buildings were undertaken in the area (2004-2005).

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

The major problem in respect of ground water in the district is the overall decline in the water level.It is apprehended that the declining ground water trend will further aggravate with installation of more tube wells. High fluoride (F) content, more than the permissible limit of 1.5 mg/l, in shallow ground water is observed at few places in the district, thus making the water harmful (unfit) for human consumption. High values of nitrates, more than the prescribed limit of 45 mg/l is also observed in shallow ground water at few places in the area.

7.0 AWARENESS & TRAINING ACTIVITY

One Mass Awareness program on Rainwater Harvesting for artificial recharge to ground water was organized at Patiala on 28th March 2003.

8.0 Areas Notified By CGWB/CGWA

Patran Block of Patiala District is notified

9.0 RECOMMENDATIONS

1. The dug wells traditionally used for the monitoring the water level in the area are either dried or abandoned in major part of the area.So, it is recommended to install shallow piezometers in Nabha, Patiala, Sanaur, Samana, Bhuner heri and Patran blocks.
2. On the declining trend of ground water level a close watch be maintained and water level should be measured at different places. For this, 10 shallow (50 m) and 10 deep (200 m) piezometers 152 mm (6") dia. Should be constructed for regular monitoring of ground water level.These piezometers should be uniformly distributed with the proper provision of collection of water samples.
3. High fluoride areas can be mapped and the public be educated about its harmful effect on human body. Small defluoridation plants can be used and mixing of water can be practiced.
4. PVC pipe assembly may be used in case of shallow tube wells.
5. It is necessary to notify the entire district for registration of all ground water abstraction structures and for the construction of any tube well, prior permission should be sought from the Central Ground Water Authority.
6. Mass awareness programme should be organized to educate the people regarding consequences of mining of ground water and need for its effective/economic use. Public awareness programme should be arranged to make the people and industry aware about the menace of ground water pollution and dwindling ground water resources in the towns.
7. More canal should be laid for irrigation so that stress on ground water can be reduced.
8. Cropping pattern in the area should be changed by growing low water consuming crops instead of paddy.
9. Improved irrigation practices should be followed in order to reduce burden on irrigation water.