GROUND WATER INFORMATION BOOKLET, FATEHGARH SAHIB DISTRICT, PUNJAB

C O N T E N T S

FATEHGARH SAHIB DISTRICT AT A GLANCE

S. NO.	Items	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	1147
	ii. Administrative Divisions	
	Number of Tehsils	04 Fatehgarh Sahib, Amloh, Khamanon & Bassi Pathana
	Number of Blocks	05 Fatehgarh Sahib, Amloh, Khamanon, Khera & Bassi Pathana
	Number of Panchayats	442
	Number of Villages	444
	iii. Population (as per 2011 Census)	599814
	iv. Average Annual Rainfall (mm)	692
2.	GEOMORPHOLOGY	
	Major Physiographic Units	Alluvium Plain
	Major Drainage	Patiala Rao,Sirhind Choe, Sirhind canal, Bhakara canal, Narwana branch, Satluj Yamuna link canal
3.	LAND USE (Sq. Km.)	
	a. Forest Area	10
	b. Net area sown	1020
	c. Total Cropped Area	1870
4.	MAJOR SOIL TYPES	Loamy sand, Sandy Loam
5.	AREA UNDER PRINCIPAL CROPS (sq km)	Kharif Crop-860 Rabi Crop - 850
6.	IRRIGATION BY DIFFERENT SOURCES (Sq. km.)	
	Dug wells	-
	Tube wells/Bore wells	1020
	Tanks/ponds	-
	Canals	-
	Other sources	-
	Net Irrigated area	1020
	Gross irrigated area	1906

7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB.	
	No. of dug wells	12
	No of Piezometers	3
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary alluvium
9.	HYDROGEOLOGY	
	*Major Water bearing formation *(Pre-monsoon depth to water level) *(Post-monsoon depth to water level	Sand & Gravel 7.65-27.24 m bgl 7.02-30.06 m bgl
10.	GROUND WATER EXPLORATION BY CGWB	
	EW OW PZ SH	01 - 03 01
	Depth range (m)	229-550
	Discharge (liters per minute)	1000-2500
	Storativity (S)	$1.26*10^{-3}$
	Transmissivity (m^2/day)	1790
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit EC, in micromhos at 25^0C F, in mg/l Fe, in mg/l As, in mg/l	 Nil 1.54 Nil Nd to 2.58
	Type of water	$NaHCO_3$ & Mixed Type
12	DYNAMIC GROUND WATER RESOURCES (2004) MCM	
	Annual Replenish able Ground water Resources	1516.03
	Net Annual Ground water Draft	2589.15
	Projected Demand for Domestic and Industrial uses (2025)	48.08
	Stage of Groundwater Development	169%
13	AWARENESS AND TRAINING ACTIVITY	Water Resources Day on 29.3.2000 at Sirhind
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING Projects completed by CGWB (No. & Amount spent) Projects under technical guidance of CGWB (Numbers)	 One Rs. 5.78 lacs One
15.	GROUND WATER CONTROL AND REGULATION	
	Number of Over Exploited Blocks.	05
	Number of Semi Critical Blocks	Nil
	Number of blocks notified	Nil
16	.MAJOR GROUND WATER PROBLEMS AND ISSUES.	Over exploitation, Declining Water Table

GROUND WATER INFORMATION BOOKLET
FATEHGARH SAHIB DISTRICT, PUNJAB

1.0 INTRODUCTION

Fatehgarh Sahib District is located in southeastern part of Punjab state and lies between 30^0 25' 00" to 30^0 45' 45" north latitude & 76^0 04' 30" to 76^0 35' 00" east longitude covering an area 1147 sq km. The district comprises of Fatehgarh sahib, Amloh, Khamanon & Bassi Pathana are four teshils of the district. Gobindgarh is the only Sub Tehsil in the district. There are five development blocks namely Fatehgarh Sahib, Amloh, Khamanon, Khera & Bassi Pathana.

The total population of the district is 5,99,814 as per 2011 census which constitutes 2.20 % total population of the state. Total population of Fatehgarh sahib district in 2001 was 5,38,041 which shows that there has been 11.39 % decennial growth (2001-2011) in the district. Population density of district is 456 persons per sq. km. against the state average of 508 persons per sq. km.

Net area irrigated in the district is 1,02,000 hectares and percentage of net area irrigated to net area shown is 100 %. Rice and wheat have gross irrigated area as 84,500 hectares each. Cotton has third large gross irrigated area as 15,800 hectares. Gross cropped area in the district is 1,91,000 hectares and gross irrigated area is 191.1 % hence percentage of gross irrigated area to gross cropped area is 100 %.

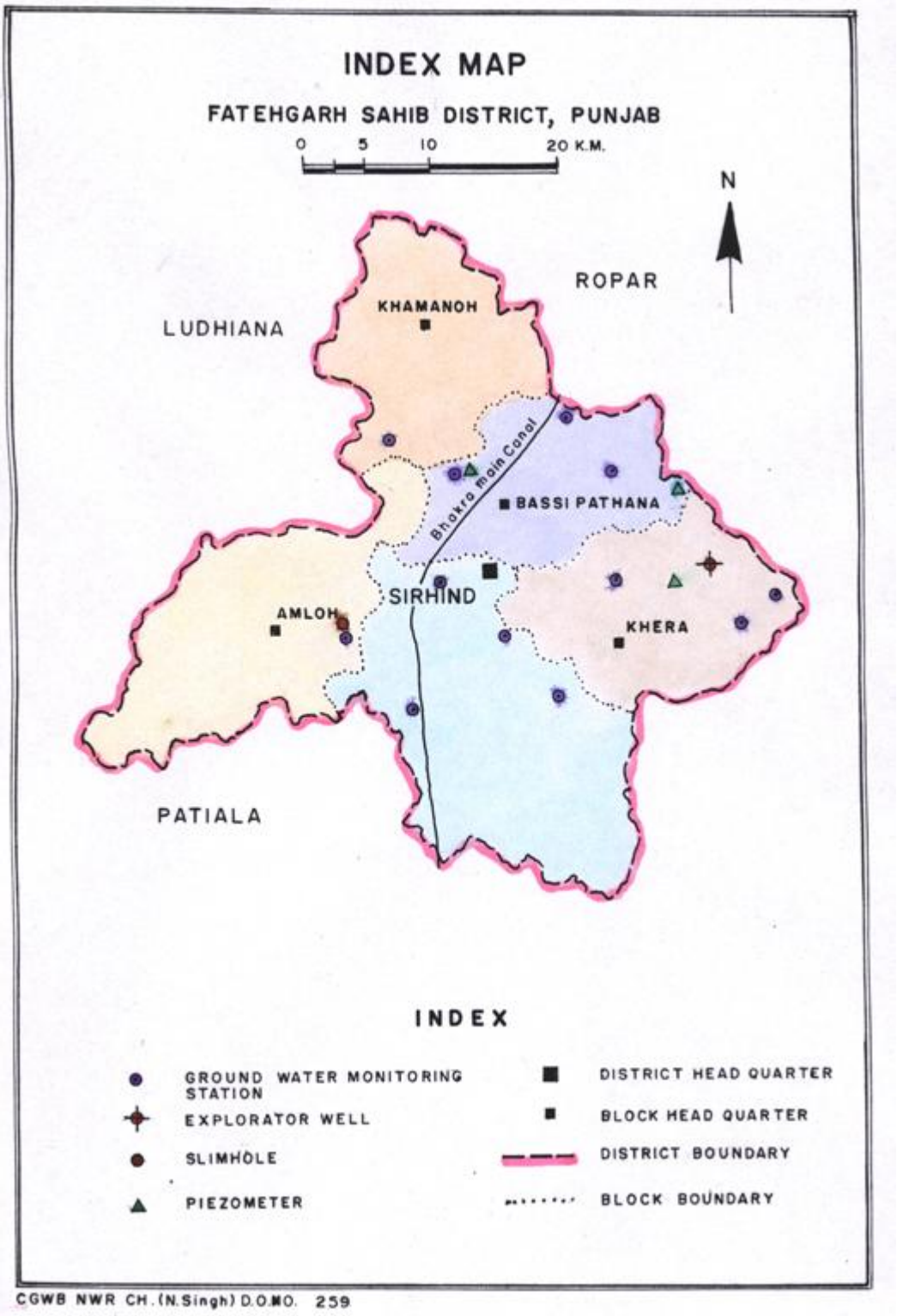
In 2011 total tubewells energized in the district was 22,820 whereas in 2005 the number of energized tubewells was 24,350 which show an increase of energized tubewells @ of 306 per year.

Four major canals passing through the district are Sirhind canal, Bhakara canal (Main Line), Narwana branch and Satluj Yamuna Link (SYL) canal. Sirhind canal passes through western part of the district from North West to south east direction where as Narwana branch bifurcates from Bhakra main canal in the central part of the district and runs from North West to south east direction. Satluj Yamuna Link canal is not in operational. The irrigation is provided by distributaries and minors of Bhakra canal only.

2.0 RAINFALL & CLIMATE

The climate of the district is classified as tropical steppe, hot and semi arid which is mainly dry with very hot summer and cold winter except during monsoon season

The normal annual rainfall of the district is 692 mm distributed over 28 days. Monsoon rainfall contributes 79 % of annual rainfall in the district. The rainfall increases from southwest to northeast in the district


INDEX MAP
FATEHGARH SAHIB DISTRICT, PUNJAB
0 5 10 20 K.M.
N
ROPAR
LUDHIANA
KHAMANOH
Bhakra main Canal
BASSI PATHANA
SIRHIND
AMLOH
KHERA
PATIALA
INDEX
GROUND WATER MONITORING STATION
EXPLORATOR WELL
SLIMHOLE
PIEZOMETER
DISTRICT HEAD QUARTER
BLOCK HEAD QUARTER
DISTRICT BOUNDARY
BLOCK BOUNDARY
CGWB NWR CH.(N.Singh) D.O.MO. 259

3.0 GEOMORPHOLOGY & SOIL

Fatehgarh sahib district falls in cis Satluj Doab between river Satluj & Yamuna. The Doab form part of Indo - Gangetic alluvial plains. Elevation of land surface ranges from 285 m amsl in the north east to 246 m amsl in south to south west direction. The general slope in the district is towards south to south west direction with an average gradient of 0.4 m per km. There are two streams which drains the area. Patiali Rao drains the eastern part of the district whereas Sirhind Choe drains central and western part of the district. River Satluj flowed through the district in the past. The paleo channels of river Satluj exists in the district.

Soils in the district are loamy sand at the surface and calcareous sandy loam in subsurface layers. Sand constitutes 80% in the soil profile. Silt constitutes 11% and clay 9% in the soils.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

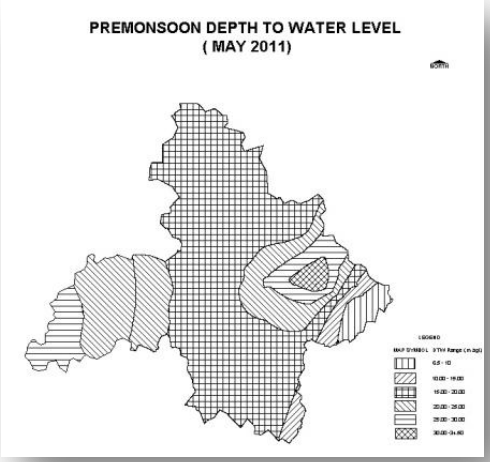
The district is underlain by formations of Quaternary age comprising of alluvium deposits belonging to vast Indus alluvial plains. Sub surface geological formations comprise of fine to coarse grained sand, silt, clay and kankar.

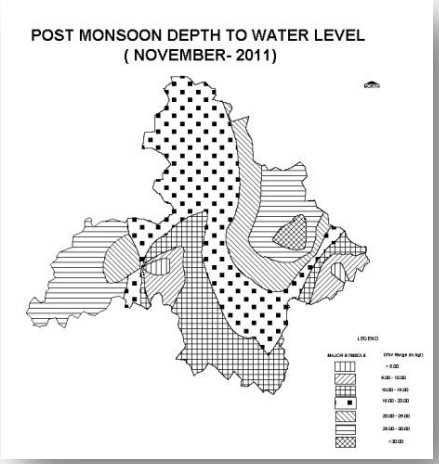
Central Ground Water Board has carried out ground water exploration up to a depth of 550 meters at village Rasulpur in Khera block. Total thickness of alluvium is expected to be more than 550 m as bed rock has not been encountered up to that depth. Subsurface geological formations show the existence of a top layer of 10 to 15 m of clay, kankar with sand lenses. This layer is followed by granular zones of 20 to 30 m in thickness and under laid by clay bed of 10 to 20 m in thickness. At a depth of 90 to 120 m another clay bed of 25 to 30 m in thickness exists. In general, the thickness of finer sediments increases below 100 m in the eastern part of the district.

Water level behavior

Depth to water level in the district ranges from 7.65 to 27.24 m bgl during pre monsoon period and between 7.02 to 30.06 m bgl during post monsoon period. In the south eastern part of the district in east of Khera block water level is less than 10 mbgl. In the northeast of Khera block water level is in the range of 20-40 m bgl. Depth to water level in rest of the district ranges between 10 to 20 m bgl..

Long term water level fluctuation (10 Years) shows a decline of 2.2 m to 6.6 m in whole of the district. Water levels have declined in the range of 5 to 6.6 m in the central & southern part of the district in Sirhind, Amloh, western part of Bassi Pathana and Khera blocks. In the eastern parts of Khera, Bassi Pathana and southern part Khamanon blocks the decline in water levels is in the range of 4 to 5 m. Minimum fall of 2 to 3 m has been observed in the northern parts of Khamanon district.





Ground water flow

Water level elevation in the district ranges from 246 m to 266 m amsl. The ground water flow direction is from north east to south west. The gradient of water table elevation is steeper in the north east part and gentle in the south west part of the district. The gradient of ground water table is 1.36 m/km in the north east and 0.45 m/km in the south west.

4.2 Ground Water Resources

The block wise ground water resource potential of the district has been assessed as per GEC-97. Ground water development in all the blocks has exceeded available recharge; hence all the blocks have been categorized as over exploited. The stage of ground water development ranges from 197 % (block Sirhind) to 243% (block Khamanon). Net Replenishable ground water availability in the district has been assessed as 53505 ham. Gross ground water draft for all uses in the district is 112483 ham, leaving a shortfall (over draft) of 59585 ham. The stage of ground water development in the district has been assessed as 210 %.

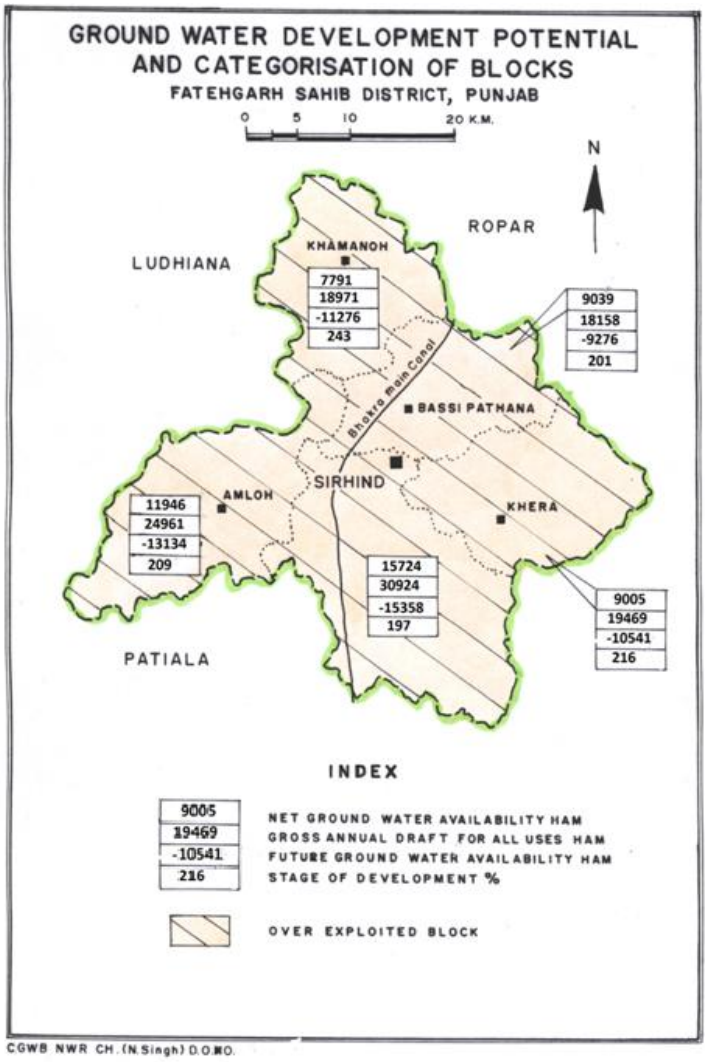
Ground Water Resources and Development Potential, Fatehgarh Sahib District, Punjab (as on 31-03-2009)

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 Requirement Supply up to next 25 years (Ham)	Net Ground Water Availability for Future Irrigation Development (Ham)	Stage of Ground Water Development (%)	Category of Block
Khera	9005	19302	168	19469	244	-10541	216	Over-Exploited
Sirhind	15724	30566	357	30924	515	-15358	197	Over-Exploited
Amloh	11946	24027	934	24961	1053	-13134	209	Over-Exploited
Bassi Pathana	9039	17815	343	18158	500	-9276	201	Over-Exploited
Khamanon	7791	18740	231	18971	328	-11276	243	Over-Exploited
Total	**53505**	**110450**	**2033**	**112483**	**2640**	**-59585**	**210**	

4.3 Ground Water Quality

Chemical quality of groundwater of shallow aquifer shows that all parameters are within the permissible limits for drinking purpose set by the BIS, 1991. Salinity, Chloride, Nitrate and Flouride are the important parameters that are normally considered for evaluating the suitability of ground water for drinking uses. Ground water occurs with in desirable levels with respect to EC (less than 1000 micromohos/cm at 25^0C), Chloride (<250 mg/l), Nitrate (< 45mg/l) and Flouride (< 1 mg/l) in all samples. As per geo-chemical classification, the shallow ground water is Ca-Mg-HCO_3 type with few exception where water is Na-HCO_3 type.

Micro level ground water regulation and protection studies were carried out in Mandi Gobindgarh city the “Steel Town” of north India. Hydrochemistry of urban area of Mandi Gobindgarh reveals that ground water from shallow and deep aquifers, in general is suitable for domestic, drinking and irrigation purposes and all chemical constituents (major cations and anions) are within the permissible limit set by BIS, 1991. However at few places shallow groundwater is polluted by heavy metals like Fe, Cu, Pb & Zn. In deeper aquifers the concentration of heavy metals is low as compared to shallow aquifers. The presence of heavy metals is due to the industrial pollution.



4.4 Status of Ground Water Development

Agriculture and allied activities is the main occupation in the district, as 84 % of the area in the district is under agriculture. Large part of the district is not covered by canal command; hence dependence on ground water is more for irrigation. There are 35814 tubewells in the district out of which 33865 are electric operated and 1949 are diesel operated.

The depth of tubewells in southern part of the district covering Sirhind and Khera blocks ranges from 50 to 200 m. Discharge of theses tubewells ranges from 1300 lpm to 2500 lpm. In the central and western part of the district, covering mainly Bassi Pathana and Amloh block, depth of tubewells ranges from 50 to 130 m and discharge of theses tubewells ranges from 1000 lpm to 1300 lpm. In the northern part of the district covering mainly Khamanon and part of Bassi Pathana block depth of tubewells ranges from 50 to 80 m and discharge of theses tubewells ranges from 600 to 1000 lpm.

Drinking water supply in rural and urban area is based on tubewells only. State govt. has constructed tubewells for domestic purpose in the depth range of 80 to 150 meters.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The whole district is suitable for ground water development. But due to over exploitation of ground water in all five blocks of the district a check is required for overall ground water development.

Ground water exploration in the eastern part shows alluvium exists down the explored depth of 550 m. Granular zones pinches out in the eastern part of the district. Based upon groundwater exploration carried out in the district a well assembly of 305 mm/203 mm with about 60 m of housing length and 1.19 mm slot size and shrouded with 1.6 -8 mm gravel would be suitable in the district.

Shallow tubewells can be constructed by lowering single diameter assembly of 203 mm and tapping granular zones below 25 m. Direct rotary rig would be suitable in the district.

5.2 Water Conservation & Artificial Recharge

Central Ground Water Board has taken up rain water harvesting and artificial recharge studies in the district. A pilot project was implemented in Deputy Commissioner office covering Administrative complex and Judicial complex at Fatehgarh sahib. In Administrative complex total area of 63438 m^2 covering rooftop area, pavement area and area of officer's colony has been covered for artificial recharge to ground water. It is expected that 22515 m^3 water will be recharge to the ground per year. In Judicial complex 2171 m^2 rooftop area has taken in to consideration and expected recharge to groundwater is 1141 m^3/year. At both the places filtration chambers cum recharge wells of 55 m to 58 m depth have been constructed.

As per master plan for artificial recharge to ground water, 640 km^2 has been identified for artificial recharge to groundwater, which has sub surface storage potential of 478 MCM. For roof top rain water harvesting 1.641 MCM

water is available for recharge. Rooftop rain water harvesting can be adopted in all buildings of the district.

Due to declining of water levels in the area, rainwater harvesting and artificial recharge to groundwater is feasible in whole of the Fatehgarh Sahib district. Types of recharge structures suitable are; Trenches and injection wells. Injection wells of 40 to 60 m depth can be constructed depending upon the local hydrogeological conditions.

The trenches of three meter depth be constructed and filled with inverted filter material up to 2m of depth, remaining one meter of depth will be kept as free board which acts as storage of storm water. The trench serves dual purpose of storing the excess water and filtering the suspended particles / silt. For construction of recharge well borehole of 450mm (18") dia is to be got drilled with the Reverse Rotary method of drilling. In case sufficient space is not available in areas close to buildings, the drilling may be taken up with hand boring and dia of borehole should be 10". Recharge well assembly of 6" dia should be lowered into the borehole. The annular space between the assembly and borehole is to be filled with gravel of 3-5 mm size. The aquifers zones to be recharged should be screened by PVC/M.S. slotted pipes. Within the trench two PVC/M.S. slotted pipes having 3 mm slot size are to be fixed on either side of the 6" dia. pipe for filtered water to enter into the recharge well. Only aquifers encountered at the bottom of borehole should be screened. After construction of trench cum recharge well, the channelized water is to be connected with the recharge structures through R.C.C. or M.S. pipes.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Water levels are declining in the district. In the last decade (2002-2012) water levels have declined at the rate of 30-90 cm/year. The rate of decline is more in the eastern part of the district. In general ground water is potable in the district. However, at few places in Mandi Gobindgarh town, shallow groundwater is polluted by heavy metals like Fe, Cu, Pb & Zn. The presence of heavy metals in ground water is due to Industrial pollution.

7.0 AWARENESS & TRAINING ACTIVITY

Water Resources day was celebrated on 29th March, 2001 at Sirhind Mandi, District Fatehgarh Sahib, Punjab in collaboration with Agriculture Department, Punjab. Deputy Commissioner, Fatehgarh Sahib was the Chief Guest. Director, Agriculture Department, Punjab presided over the function and Joint Director, Agriculture Department, Punjab graced the occasion. Scientists from Punjab Agriculture University, Ludhiana, Officers of State Govt. and representatives of farmers speak during the occasion. About one thousand farmers attended the function. A brochure on District Fatehgarh Sahib in English and Punjabi languages released during the occasion by the Chief Guest. Exhibition showing activities of Central Ground Water Board, NWR organized during the programme. The function was widely covered by the Press and local T.V. media.

8.0 AREAS NOTIFIED BY CGWA/SGWA

Central Ground Water Authority has notified 3 blocks namely Amloh, Khamano and Khera in the district for ground water registration/regulation on 27-11-2012. There is an urgent need that a "Model Bill" to regulate and control the development and management of ground water be prepared by the State Government.

9.0 RECOMMENDATIONS

The following remedial measures are recommended to reduce the over exploitation and declining trend of ground water in Fatehgarh Sahib district.

1. All five blocks in Fatehgarh Sahib District are over exploited; hence, it is necessary to notify the remaining two blocks i.e. Bassi Pathana and Sirhind for registration of ground water abstraction structures and for regulation of ground water abstraction. After the notification permission should be sought from Central Ground Water Authority for construction of any tubewell.
2. Rainwater harvesting and artificial recharge to ground water should be adopted to check further decline in ground water, since natural recharge to aquifer system is not adequate to support heavy withdrawal of ground water.
3. In the industrial town of Mandi Gobindgarh, industries are discharging toxic effluents either on ground in the industrial premises or into city sewerage drains. Industrial effluents should be suitably disposed off after tertiary treatment and solid waste be treated using scientific techniques.
4. Farmers have adopted paddy cultivation due to its profitability and incentives from Government. Paddy requires much more irrigation water in comparison to other crops. Thus a change in cropping pattern is required.
5. Paddy shown in the month of May requires more evapo-transpiration than paddy shown after 15th June. Thus a lot of water can be saved by timely plantation of Paddy. Farmers should be made be aware of timely plantation of paddy.
6. Canal command area in the district is very small; hence most of the irrigation is done through tubewells. More area should be brought under canal command area. A change in irrigation policy in the district is required.
7. Efficient irrigation practices like sprinkler irrigation should be adopted.
8. Mass awareness camps be organised throughout the district to educate people for groundwater management and need for its efficient/economic use